SCIENTIFIC AMERICAN

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THE HOLDEN ICE MACHINE.

In our issue of August 18, 1877, we illustrated and described in detail the above named invention, showing its application to refrigerating purposes in breweries. The machine has recently been adapted to ice making, and has achieved, we are informed, very notable success. In using it for this purpose the manufacturers have added some valuable improvements which have materially increased its efficiency, and to these, more especially, it is our object now to direct the reader's attention.

The machine is adapted to the use of any volatile liquid, such as common ether, methylic ether, chymogene, sulphurous oxide, etc., the vapor of which is used to lower the temperature of a non-congealable liquid, and this last freezes the water contained in suitable vessels and immersed in it. The action of the apparatus, as shown on the left of Fig. 1, is briefly as follows: A is the engine; B B are circulating pumps, which force the non-congealable liquid through a rotating coil in the cylinder, C, thence into the freezing tank, D. From the further extremities of the latter the liquid is conducted by the pipe, E, back to the pumps, and so passes again to the cylinder. At the bottom of the cylinder the ether or chymogene is placed so that the coil through which the water passes as it revolves dips in the volatile material, and the thin film of this which remains on the core is rapidly evaporated through the action of the pumps, F, which communicate with the cylinder by the pipe, G. In this way the temperature of the non-congealable liquid passing through the tubes is lowered. The vapor carried off by the pumps is by them driven into the condenser, H, and here it is cooled by water, liquefied and collected in the reservoir, I, whence it once more passes to the bottom of the cylinder, C. It will be noticed that there are two circulations, one of the non-congealable liquid, through cylinder, C, pumps, B, and tank, D, and another of the volatile material, or its vapor, through cylinder, C, pumps, F, condenser, H, and reservoir, I.

The new portions of the apparatus can now be clearly understood; and these are found in the tank, D, and its appurtenances. The water to be cooled is placed in deep cans, thirteen of which are set in a carrier, as shown in Fig. 2. When the cans are immersed in the tank, this carrier extends across the same, and the rollers at its extremities rest on ways made on the sides, as shown in the transverse section Fig. 3, page 162. The tank is capable of holding twenty-six of these carriers placed side by side. That is, this number would be inserted at the beginning of operations.

Above the tank is a traveling crane, which is used for lifting the carriers with their cans out of or into the freezing liquid. Obviously the latter is coldest at its point of entry, and therefore the ice is removed by the crane from that extremity, and transported over the tank to a bath at J, into which the cans are dipped for a moment to loosen their contents, and the ice is then turned out on an inclined plane.

Meanwhile the attendant revolves the wheel, K, which, by a pinion, operates a rack which pushes the carriers bodily to the further end of the tank, so as to close up the space left by the carrier removed, and to afford a place on the right for the insertion of the same carrier, the cans of which are at once refilled with water. The crane then moves forward again and takes out the endmost carrier, and thus the operation continues, carriers newly filled being inserted at one extremity, while those the contents of the cans of which are frozen are removed from the other.

The economy of this arrangement will be obvious when the varying temperature of the liquid in the tank is remembered. The newly filled cans enter liquid of a temperature of, say, 32°, a film of ice at once forms, and as they gradually move forward they are subjected to greater degrees of cold as the ice film thickens, until finally they reach the coldest point, when the warmth of the remaining uncongealed water has to be extracted through the greatest thickness of ice. The cold, to use a very unphilosophical but

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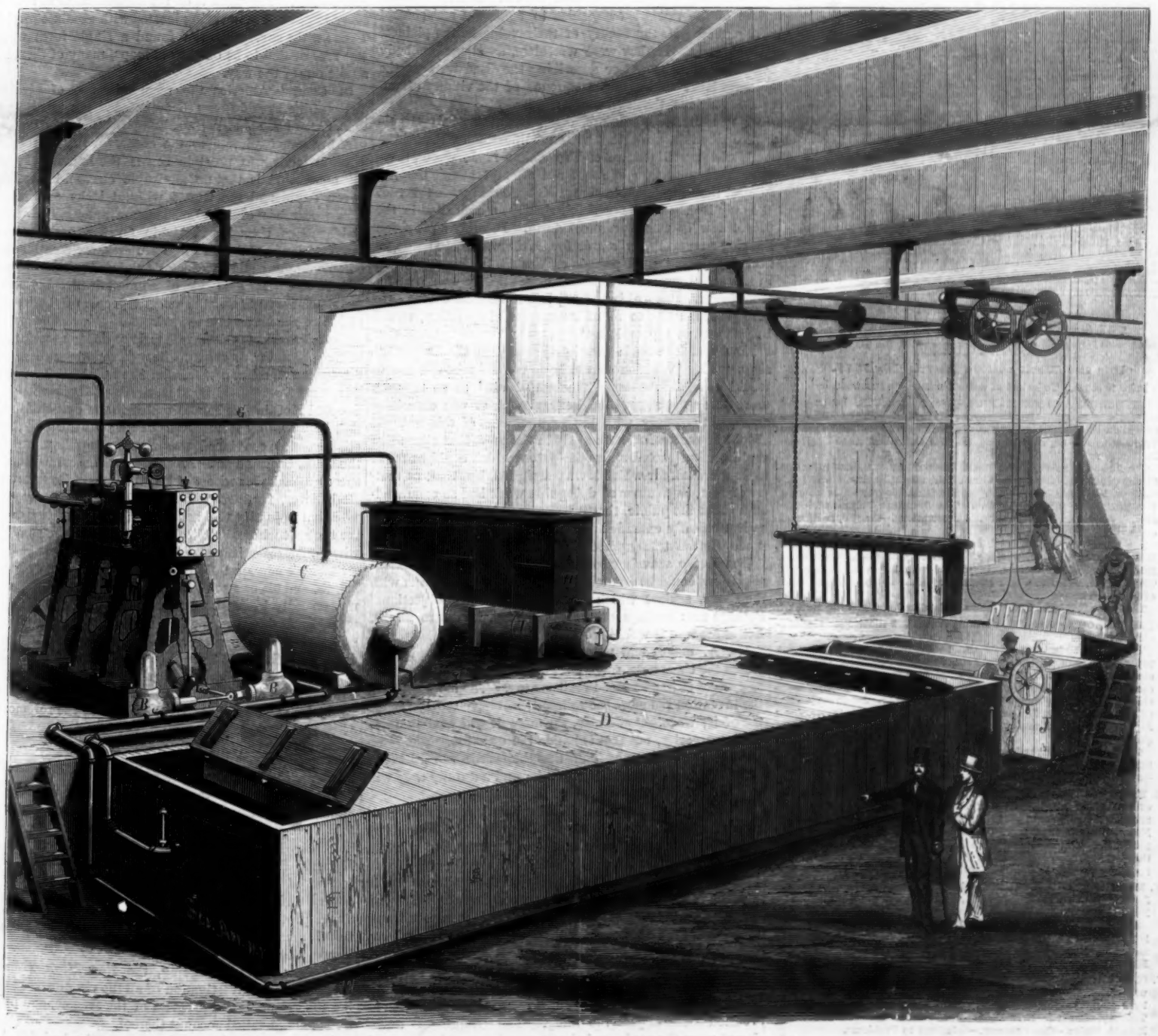

THE HOLDEN ICE MACHINE.

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(Illustrated articles are marked with an asterisk.)

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WANTED: A LEGAL PROCESS FOR CONFISCATING INVENTIONS.

Seriously, a legal process for the confiscation of certain kinds of property is just now urgently called for. It is very much needed—by a few rattle-brained extremists of the communistic sort, do you say?

We do not mean them. They are neither numerous enough nor influential enough to be taken account of here. The parties now begging for legal power to seize and convert to their own uses such property as they desire and do not wish to pay for, are not communists. They have a most wholesome respect for tangible property. They are clear-headed business men, and rank among the most honored and honorable in the land.

Impossible? Paradoxical rather, yet absolutely true. The parties interested in this iniquitous scheme are great among the financial and political powers; and they mean to get what they want. Already a bill drawn in their interest is before Congress, and there is no small danger of its becoming a law. The property they covet is, to be sure, intellectual property; but that does not change in the least the principles involved. Nor does it lessen in the least the wrong of the proposed robbery to describe the property to be seized upon as "abandoned and worthless."

The logic of the would be confiscators' plea runs somewhat like this. Certain persons have taken out patents which have no real or practical value. The inventions patented have never been put into successful use, either because of imperfection or because the owners of them have not had the means to develop them. Be that as it may, the patents lie undeveloped or abandoned, consequently worthless. But these worthless patents are a serious hinderance to the complainants, who want to use the principles or devices they involve in the conduct of their affairs. To be restrained from so using them by the unexpired life of the patents, is to be subjected to inconvenience and serious loss. Consequently the complainants demand that the patent law be so changed that they may freely use these "worthless" yet desirable devices without being called upon to account therefor to the inventors.

Speaking in behalf of railway corporations, the *Chicago Railway Review* puts this plea very plainly; and argues it with amusing unconsciousness of the circumstance that the desire of the railway companies to confiscate and control such patents puts the reality of their value in the plainest possible light. If they were worthless, as alleged, nobody would want them. After describing the disadvantages the railways labor under in consequence of the vitality of unused inventions, the *Review* says:

"The railroads, therefore, demand nothing but simple justice when they ask that some modification of the law be made which will put an end to claims made under these abandoned patents. We will not attempt, at this time, to suggest the exact modification which would secure this end. We only insist that the principle should be embodied in the patent law in some practical form. Possibly a provision limiting a recovery, in a suit for infringement, to damages accruing during such periods only while the invention was in successful public use, under direct license or authority from the patentee or his assigns, and to such an extent as to give general notice to all of its successful operation, would be sufficient to accomplish the purpose."

No doubt it would: certainly in case, as the *Review* insists: "This provision should be so worded that the courts would construe the term 'successful use' so as to mean more than a mere provisional experiment, or one especially arranged to comply with the requirements of this act. It should be successful, not merely in the sense that a machine could be constructed under the patent which could be made to do the work for which it was designed, but that, as matter of fact, its manner of doing this work had so commended itself to the public, that it had passed into such profitable and sufficiently extended use as to entitle it to be termed a success in the ordinary acceptation of that term."

The *Review* suavely remarks that "much more stringent provisions could be framed;" but it considerately rests with the above, against which it can see no "just objection." Perhaps not: perhaps, on the other hand, inventors might. Let us see how it would work.

Mr. A. makes and patents an invention designed to increase the cheapness, safety, or simplicity of some appliance or process of importance in railroading. The more valuable the invention the more the railroads will have to pay for the use of it; we might add also, the more it will contribute to their prosperity, but that is beside the question. The pregnant fact in this connection is that the railroads will have to pay for the invention if they use it; and naturally they will prefer to use it without paying.

Now the inventor cannot build railroads for the sole purpose of applying his invention. To prove it successful "in the ordinary acceptation of that term," as the *Review* has it, the invention must be used continuously and profitably on some existing road. The interest of the railways lies in proving it not a success, and the proof rests entirely with them. The invention is tried, but for obvious reasons its use stops with "a mere provisional experiment." The railway officials declare it a failure, and prove it such, in the eye of the law, by declining to use it.

Subsequently the proper person in one of the railway shops makes the required "improvement," whereby the invention becomes just the thing. The "improved" device is put upon the roads, and the companies reap their reward. Meantime the real inventor is out in the cold. He may whistle for his pay, since the law debars his recovering anything for the "worthless and abandoned" prior invention, which never passed beyond a mere preliminary trial.

Candidly, the communists' demand for a "fair divide" is manly and honest compared with such a roundabout legal confiscation of all an inventor's rights.

We do not charge the advocates of the proposed amendment of the patent law with any intentional robbery: they have merely made their demand a little too strong. It rests with Congress to say whether progress in the sciences and the practical arts is to be "encouraged" by devices so transparently unfair to inventors.

GEOGRAPHICAL PROGRESS.

The annual address of the President of the American Geographical Society furnishes as usual an interesting review of the past year's work in geographical exploration. The grandeur of Stanley's achievement dwarfs all the rest to relative insignificance; nevertheless enough else was done in other parts of the world to make the year a notable one for geography even with Stanley's work left out.

In our own western territories and in certain portions of South America an unusual number of expeditions for geographical exploration have been sent out; and considerable good work has been done also in Central and Eastern Asia, the Indian Archipelago, and Australia. In Asia many explorers have been at work in Palestine, Persia, Turkestan, Thibet, China, India, and Japan. In South America Rivira and Werthemere have explored the mountains of Peru; Weiner has been at work in Bolivia, and Moreno in Patagonia.

At home the explorations of the United States corps of engineers have been, as our readers already know, both extensive and notably successful. The same may be said of the surveys under the direction of Professor Hayden. Of more immediate interest to ourselves has been the resurvey of the eastern portion of our own State. The triangulation has been carried through the eastern central part of the State, covering an area of 3,000 square miles between the Hudson river and the sources of the Mohawk, as far west as Utica, and embracing parts of eleven counties. During the coming season the triangulation will be carried across the entire State. The work is of the highest order of accuracy, every important point being located with absolute precision. Thus far the survey has not found a single town where it was represented to be on the old maps, many of them being a mile out of the way.

In Central America the reconnoissance of Lieutenant Wyse of the French navy has exploded the reports which the French have held to (in spite of the abundant testimony of American explorers to the contrary) that a ship canal without locks was possible across the Isthmus of Darien. His conclusion is that no navigable channel is possible between Tuyra and the Otrato without locks or tunneling. The researches of Dr. Le Plongeon among the ruins of Chichen Itza, Uxmal, and Aké in Yucatan, and on the once famous islands of Azumel and Mujeres, are mentioned with commendation; and the doctor's claims to the discovery of written and other evidence of communication between the people of Yucatan and the ancient people of the west coast of Africa are favorably noticed.

No real work was done in Arctic regions; considerable attention, however, is given to Barry's reports with regard to the finding of relics of Sir John Franklin's ill-fated expedition, near the Gulf of Boothia, north of Hudson's Bay. Sir Leopold McClintock has intimated to the British Admiralty that Barry's story is not worth much; Justice Daly, on the other hand, is convinced that Barry not only means to tell the truth, but has a sufficient acquaintance with Esquimaux speech to make his report of Esquimaux stories trustworthy. He believes, further, that the information Barry gives is sufficient to justify the sending of an expedition to examine the spot where the Netchelli say the white men died, and where their cairn is containing books and papers.

Stanley's conquest of the Congo is next reviewed at great length, and his course in fighting his way, when opposed, is unreservedly justified. Summing up the whole of Stanley's work in Africa, the speaker said, "It may truthfully be said that no man has ever, in explorations upon the land, done so much for the acquisition of geographical information," and with respect to the Congo and the Nile, "He has solved an enigma that has attracted the attention of the world for ages, and has fixed his name in the foremost rank of geographers, explorers, and travelers."

A CONGRESSIONAL SCIENTIFIC EXPEDITION.

The Senate Committee on Commerce has reported favorably a bill to authorize the granting of an American register to a foreign built ship for the purposes of the Woodruff Scientific Expedition. The bill has already passed the House of Representatives; and it operates to enable the projectors of the above named scheme to purchase a vessel abroad and sail her wherever they choose under the national protection. The measure also virtually gives national recognition to the project as of superior scientific importance.

In view of the foregoing, the New York *Tribune* has made a careful investigation of all the circumstances attending the inception and progress of the scheme, and publishes a long and detailed account thereof.

A couple of bankrupt adventurers who had failed disastrously in one of the real estate schemes common in the

growing cities of the West, revamped the old idea of a traveling expedition, called it "scientific" to commend it to the intelligent, and came to New York city to set it in operation. College professors were interviewed, and their support obtained through the magnificent prospectus set forth, and a show of substantial backing was thus secured. The preliminaries to chartering a vessel were begun, and then the mails were flooded with pamphlets replete with glowing descriptions, combined with gross inconsistencies and misrepresentations. The subscribers, however, who were expected to come forward and pay $5,000 each for the privilege of accompanying the expedition, failed to appear, and the contract for the vessel expired by limitation.

The next step was to cut down prices, begin preliminaries again for a cheaper vessel, and send out a fresh batch of advertisements, in which misrepresentations were even more frequent than before. This also met with no success, and the projectors, finding that financial ingenuity and unlimited assurance were not as attractive as they imagined, sought in the person of Mr. John Roach, the well known shipbuilder, an indorser who would build them a ship, and by so doing commend their wild cat enterprise to public favor. But Mr. Roach was not to be so easily captured. He liked the idea of a scientific expedition, and was willing to help it by building a fine vessel on very liberal terms; but the projectors he evidently did not fancy, as he insisted on their placing the management in the hands of a well known banking house of this city, and in those of a committee of parents of subscribers—when the latter should appear. The adventurous couple, however, calmly disregarded this promise, and the result was another batch of advertisements asserting positively that Mr. Roach guaranteed the scheme, etc., which Mr. Roach promptly suppressed.

Thus, after three trials, the Woodruff Scientific Expedition consisted of only its two originators, for the naval officers and professors who had been induced to lend their names by specious promises had long since backed out. But the genius of the pair was still fertile. They remembered the hundreds of old steamers retired from service, now rotting in English docks. One of these can be obtained almost on any terms, and the grant of an American register would probably obviate the necessity of any payments, and allow them to get the ship "on tick." Accordingly, with unblushing audacity, which bears its falsity on its face, the couple coolly inform Congress that there are at present no ships under our flag suitable for their purpose, and demand a register for a foreign hulk.

The whole business is a miserable catch-penny deception, based on nothing but speculation. To stamp it as representative of American science would be shamefully unjust to all who have the real scientific advancement of the country at heart, and discreditable to the nation generally. Congress should promptly throw out the bill and leave this pair of speculators to invent a scheme which will not make the country a participant in their jobbery.

EDUCATED BRUTES AT THE NEW YORK AQUARIUM.

There is now on exhibition at the New York Aquarium a collection of trained animals, the performances of which indicate a degree of intelligence which is very remarkable. There are ten Broncho horses, a number of dogs, and a pair of Rocky Mountain goats, all of which possess accomplishments sufficient to fill up a long and interesting programme. It is stated that the horses were wild upon the plains three years ago, and consequently that during this brief period their education has been effected. In beginning the performances the whole ten are first introduced, and at the word of command they perform various military evolutions, such as marching in line abreast, in columns of fours by the flanks, etc., both at common and quick time. A handkerchief given to one is passed to the next and so on from mouth to mouth of the ten; any one horse called by name steps forward, and finally the act is closed by one of the number, who goes to each of his comrades in turn, and, crowding him out of the line, pushes him with his nose as a signal for exit.

Each horse is then introduced in turn to exhibit his special accomplishments. One walks up and to the middle of a balanced board, and there by moving his fore feet oscillates the plank, accommodating every muscle of his body to the movement. Finally he retires to one end of the board, bearing that extremity down and leaving the other high in the air. A second horse now called in puts his nose over the elevated end of the plank, forces it down until he can plant his fore hoofs on it, and then mounts thereon. The curious sight is then presented of two horses at the respective ends of the "teeter" gravely swinging each other up and down. The difficulty of teaching all this to an animal so careful as to stepping on insecure supports as the horse is can well be imagined. Perhaps the most remarkable feats accomplished on the board, which is quite narrow, are the turning around of a horse (who stands directly over the fulcrum, and is compelled while turning to balance himself with great care), and the rolling of a barrel over the whole length of the plank. Trainers find that it is an exceedingly troublesome undertaking to get a horse to do anything with his front hoofs which involves raising them to any height, but here the animal plants both hoofs on a barrel and rolls it up one side of the balanced board. Then as the latter swings over the horse catches the barrel with the rear side of his hoofs, and walks down the steep incline holding the barrel back. There are several tricks commonly performed by trained horses in circuses which these animals execute with remarkable readiness and accuracy. One of them selects a flag of a given color out of three of different hues; another unties a handkerchief knotted around his hind leg, or around that of another horse; a third jumps over a gate, then turns and pulls a string which fires a pistol attached to its surcingle; a fourth waltzes in excellent time to music; and a fifth, a magnificent cream colored animal, accomplishes an astonishing leap over a six foot gate and four horses placed side by side against it.

The exhibition of the horses is followed by that of a troupe of dogs, one of which exhibits considerable skill as a rider on a pad saddle. It leaps over banners and through paper hoops, and finally springs upon a platform under which the horse passes. Then as the horse returns at a gallop around the ring the dog springs from the platform back upon the saddle. The eagerness of the dog in watching for the return of the horse, and its prompt retrial in case of failure, seem to show that it takes actual pleasure in its performances.

The troupe of trained dogs appear to belong to no particular breed—a fact somewhat extraordinary, as trainers usually prefer to teach the intelligent French poodle. The performance opens with roll call, each dog answering to its name by a sharp bark. One animal then dances, two dance on their hind legs and seat themselves human fashion in small chairs, and others jump the rope. The most curious trick is one in which all participate. At the word of the trainer one of the animals takes off its collar with its fore paws. As the collar falls upon the ground a little dog runs forward, seizes it, and scampers away. Another animal pursues him, regains the collar, and puts it on. The trainer then asks, "What ought to be done to a dog that steals?" No sooner are these words uttered than two dogs jump upon chairs, to which uprights having large hooks at their upper extremities are secured. A third dog picks up a cross bar in his mouth, carries it to the two on the chairs, and these lift it up and insert it on the hooks. The trainer meanwhile slips a noose over the small thief's head, and another dog grasps the end of the rope and drags the culprit to the gallows. The problem then is how to get the rope over the cross bar, but this is quickly settled by the executioner jumping over the bar with the rope in his mouth. The hangman then pulls the cord, and lifts the struggling victim into the air, keeps him up for a few moments, and lowers him apparently dead. A wagon is now brought in and the hanged dog placed in front. Immediately one large dog places himself between the shafts, two more seat themselves upright on the seats, and another two push the vehicle from behind, and with the exit of the latter this little melodrama, which is played through without a word from the trainer or any other help than the affixing of the noose, terminates.

The accomplishments of the Rocky Mountain goats—large white animals with enormous horns—are the more curious, when the stupid, phlegmatic nature of the brute is remembered. Yet they leap upon the backs of horses, ride around the ring at full gallop, and are not displaced even when the horses take flying leaps over high fences. One of the goats emulates the dog in leaping upon and from a platform; but the solemn manner in which this is done, and the pertinacity with which the goat refuses to jump down until the horse is placed in what he considers exactly the proper position beneath him, are very ludicrous. A remarkable act performed by both goats is circling from one horse to another while at full gallop. The horses run side by side, and the goat on one places his fore feet on one pad and hind feet on the other; the other goat does the same. Then they follow each other in a circle, passing from horse to horse and back again.

The Aquarium is rapidly accumulating a collection of really wonderful specimens of the brute creation. A large cage now contains a dozen or so flying foxes—the nearest living link between bird and brute—which eke out their inverted lives hanging from the top bars of their prison. The monkey-faced hen we described in a recent number constantly attracts a curious crowd. A huge rattlesnake has recently been added, and divides popular interest with the baby hippopotamus and the giraffes. The latest addition was a pair of young chimpanzees, captured in the northern part of Africa, one of which has since died. The young male had the look of an old man, and the resemblance was ludicrously enhanced by the grave manner in which he sat and regarded visitors, while placidly pulling the tuft of white whisker under his chin. The female is covered with long black straight hair, especially about the head. She is the least ugly of the two in face. We shall probably present a picture of this interesting pair before long, as they are the first of their species ever brought over to this country.

It is hardly necessary to add that with the splendid collection of rare fishes, in addition to the above named attractions, the Aquarium just now is an exceedingly interesting place to visit.

Professor C. V. Riley.

We understand that the present entomologist of the Department of Agriculture is about to retire, and that the Commissioner contemplates calling Professor C. V. Riley to that post. Professor Riley is well known as the Chief of the United States Entomological Commission charged with the study of the insect pests which have devastated portions of the West, as State Entomologist of Missouri, and as an exceedingly able writer on all entomological subjects. His labors in this field have been long, arduous, and fruitful, with many contributions to knowledge. The Commissioner could hardly find a scientist more thoroughly suited to the position above mentioned.

"HEAT IS LIFE—COLD IS DEATH."

There is no greater fallacy than the opinion held by many, particularly the young and strong and vigorous, that winter—especially a sharp, frosty one, with plenty of snow—is the most healthy season of the year. Very few persons seem to realize the fact that cold is the condition of death, and that, in both warm and cold climates, it is our unconscious effort to maintain our bodily heat at a temperature of 98° that wears us out. To this temperature, called "blood heat," every cubic inch of oxygen that serves to vitalize our blood must be raised by our own bodily heat, or life ceases. Since in cold weather the maintenance of a sufficiently elevated bodily temperature becomes very often a difficulty too great for our strength, the advent of a severe winter is really more to be dreaded than the visitation of a pestilence.

The saying, "Heat is life—cold is death," has a striking illustration and confirmation in the reports now regularly submitted by Dr. Russell to the Glasgow Sanitary Committee. The death rate rises and falls with the regularity of the thermometer. So many degrees less heat, so many more deaths, and *vice versa*. In a recent fortnightly report Dr. Russell says: "The death rate in the first week of the fortnight was twenty-one, in the second week twenty-five. The mean temperature in the former week was 40·8° Fah., in the latter 39·5°." He attributes the low rate of the first week to the high mean temperature of the preceding fortnight, which was 47·3°, and adds: "This is a good illustration of a law which we frequently observe in these reports of temperatures and death rates—that a week of low temperature produces a rise in mortality the week following."

In our climate it would probably be difficult to find a more frequent cause of serious ailments than taking cold. Whatever weak place we have, whatever constitutional disorder we be subject to, cold will surely discover. We take cold because our vitality is too low to ward off the effects of the reduced temperature around us. As a matter of the first importance, then, to resist cold and the various derangements of the system consequent, it is necessary by proper nutrition to maintain our natural animal heat; second, to retain this heat by a sufficient quantity of clothing; third, to regulate with care the temperature of the air we breathe. Contrary to the opinion current among lovers of cold weather, a fire in a bedroom in the winter is cheaper and better than a doctor's bill; for, owing to our inactive condition during sleep, the circulation of the vitalizing blood is both slow and imperfect, and hence the danger of taking cold by breathing cold air is greatly increased.

A cold is the beginning of everything that is bad. If any one conscious of having caught one feels cold chills creeping up the back, let him apply a mustard plaster to the bottom of the spine and lower part of the back at once; and by so doing he may avert a dangerous illness before it is too late and medical advice can be procured. It should never be forgotten that "Heat is life—cold is death."

THE LESSON OF THE CHINESE FAMINE.

In the northern province of China seventy millions of people are starving. Famine is no infrequent visitor in those parts, but never before has abject want been so widespread or severe.

For centuries the sterilizing influences, which have converted the once densely populated regions of central Asia into a vast desert, have been reaching eastward. During the past two hundred years the desert has been encroaching upon northern China, the regions now afflicted undergoing in that time a climatic change almost without parallel in the history of civilized countries.

The fertilizing water courses have disappeared; massive bridges now span river beds whose floods have wasted; and everywhere the traveler finds evidence of a former population rivaling in density that of the still fertile regions of South China. Repeated local famines and civil disturbances resulting therefrom have greatly thinned the population; yet in the afflicted region there still remain probably twice as many people as there are in all the United States. And these are not only starving, but are almost hopelessly beyond the reach of relief from without. Formerly the deficiencies of northern China were supplied from the south by way of the great canal, extending 650 miles from Soochow to Tientsin, on the Peiho, near Pekin. For a thousand years this was the greatest artery of commerce in the world; but it lost its feeders, and became for the most part unnavigable, when the Yang-tse-Kiang shifted its channel and found a new outlet three hundred miles to the north of its old one. Thus cut off from its only source of relief in case of failing crops, with scanty means of internal communication, and subject to a government that has not the energy to combat so dire an evil, even if it had the power, the stricken region must bear its affliction as best it may. Millions must die, while the rest of the world looks on appalled by the magnitude of the disaster, yet impotent to relieve its victims.

To the world it is but another illustration of the pitiless sequence of material cause and effect, against which the prayers of 70,000,000 human beings have no more influence than the cries of as many insects. Will it be anything more to China? The experience of civilization has been that the surest means of averting famines are found in good and abundant roads. No failure of crops, however complete, could create a famine along a line of railway, nor in a country well supplied with such means of quick communication. In tearing up the first and only line of railway in China, the government has but lately shown its hostility to this instrument and safeguard of civilization.

[*Continued from first page.*]

convenient term, is thus economized to the extent that, instead of the entire contents of the tank being reduced to, say, zero, the temperature of only a portion of the same is thus lowered, with equally as good results.

The manufacturers have recently constructed one of these machines for the Virginia and Gold Hill Water Company, of Virginia City, Nevada. From the report of the superintendent submitted, we learn that, although the contract requirement was 15 tons of ice in 24 hours on actual trial, the results exceeded 20 tons, with indications that even this yield could be surpassed, the apparatus working at only two thirds of its capacity. For brewers' purposes the Holden machine is already favorably known through its successful use in the brewery of Messrs. Bergner & Engel, in Philadelphia.

For further particulars address the manufacturers, Messrs. D. L. Holden & Bros., Penn Iron Works, corner Beach and Palmer Sts., or P. O. Box 1808, Philadelphia, Pa.

THE NATIONAL STEAM PUMP.

Among the numerous steam pumps now constructed for manufacturing, mining, and other purposes, the one represented here has received much attention for its simplicity, strength, and efficiency. The improvements that have been introduced from time to time, in order to render it valuable for general as well as specific requirements, are protected by numerous letters patent, and these improvements have been recognized by competent judges and experts who have carefully and critically examined its distinguishing features. It was awarded one of the highest medals at the Centennial Exposition, a silver medal and diploma at the Fair of the American Institute in 1876, and also a silver medal at the New Jersey State Fair held during the same year.

The engraving is a perspective view of this pump in complete working order, and from this the exterior form and the general disposition of its mechanism will be readily comprehended.

The pump is one of the direct-acting kind. The centers of the steam cylinder and pump cylinder are in the same horizontal line, and the steam piston and pump plunger are connected by the same rod. The steam and pump cylinders are each secured to the foundation by a strongly-ribbed support, the base of which is well spread to allow the insertion of strong bolts, and both cylinders are connected together by three horizontal wrought iron brace rods, which keep the strain between the two in a direct and central line. The steam piston and pump plunger have packing rings, actuated by the pressure within their respective cylinders. One of the most important features is the mechanism of the valve gear, which consists of an auxiliary motor that operates the valve of the main engine when it is in an inoperative state—that is, when the main engine is at the point of reversing—and comprises the usual number of elements, namely, an auxiliary steam cylinder with its piston and valve. The main steam valve is the well known piston valve, performing with its opposite ends or faces the function of the auxiliary piston, and the main valve stem the function of auxiliary valve in combination with the main valve chest, which also performs the office of an auxiliary cylinder.

This pump has no dead centers where it will stop. It will start from any part of the stroke without the use of any starting bar or hand work to get it over the center; and one of the especial points of excellence which it possesses is, that it will work its steam valve with water, and will start even if the steam pipe is filled with the water of condensation, as is very often the case in factories where the pump is not in continual use. In most pumps, where the main valve is operated by steam admitted by a small auxiliary valve, when moving at a high speed, the steam will not work the main valve quick enough, and consequently the piston strikes the head of the cylinder. This objection is entirely overcome in this pump. When running slowly, the steam operates the main valve; but if, in running rapidly, the steam should not operate the valve quickly enough, then the momentum of the main piston rod, which is connected direct with the valve rod, by means of a tappet, will reverse the valve, and thus change the direction of the piston before it can strike the cylinder head, so that at any speed there will invariably be a full port of steam for the return stroke before the piston reaches the end of the stroke.

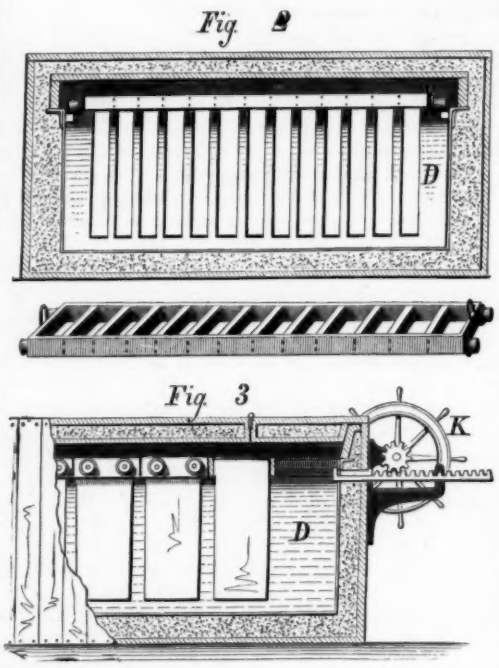
The water passages are very large and ample, and in consequence of the valves being in the cylinder heads it is possible to do away with all crooked and complicated water passages, thus reducing the loss of power caused by the friction of the water in turning short corners in crooked passages, and making the pump work with greater ease and economy.

In the water cylinder the valves and valve seats are placed in the cylinder heads, and are easily removed or replaced without disturbing the air chamber, suction, or discharge pipe.

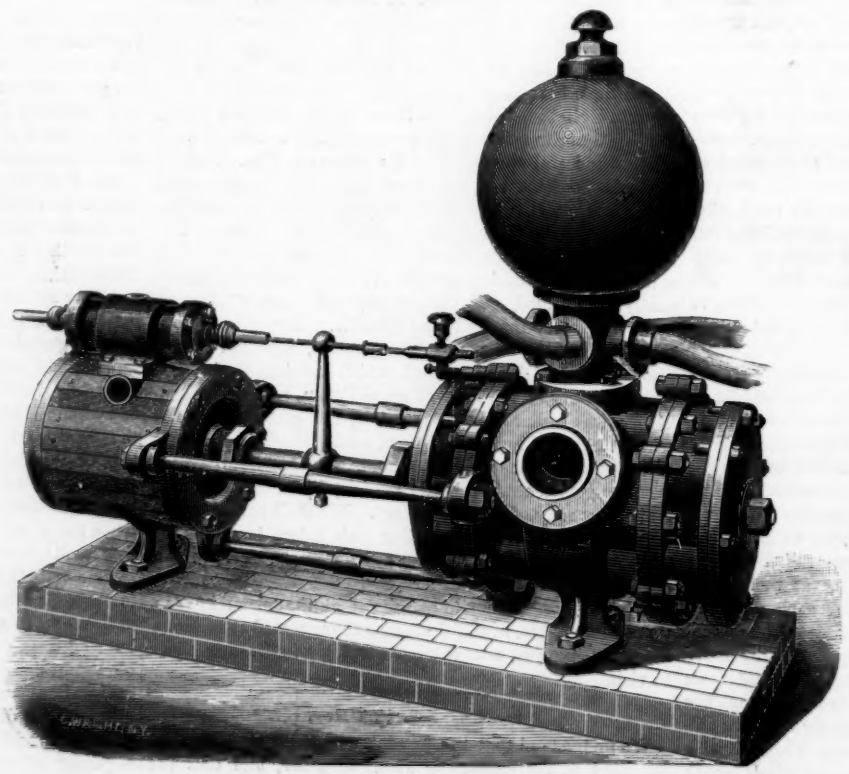
All parts are made interchangeable, so that in case of wear or accidental breakage duplicate parts can be supplied without the trouble and annoyance of taking out the pump and sending it to the manufactory.

The best materials are used in the construction of these pumps. The piston rods, valves, valve seats, and the linings in the water cylinder, are of the best composition metal.

Pumps of this description are constructed at the National Iron Works, New Brunswick, N. J. Wm. E. Kelly and Brother are the general agents for these pumps at 46 Cortlandt street, New York city, where an extensive stock is on hand and where all further information can be obtained.



HOLDEN ICE MACHINE.



THE NATIONAL STEAM PUMP.

Color Vision.

From a series of experiments with regard to the varying capacity of the eye to distinguish colors in different parts, Dobrowotsky finds that if the same illumination be given to disks of different colors, white, and coincidently blue, are first perceived in all parts of the retina, then green, and finally red. Another observer, Woinow, finds in regard to colors three zones of perceptivity around the *macula lutea*. In the first zone, immediately surrounding the spot, all colors appear less saturated than in the center, some of them being apparently bluish or yellowish. In the second zone only yellow and blue are distinguished, while mixed colors appear pure yellow if (when seen with the *fovea centralis*) they seem to contain much yellow or pure blue. In the third or outermost zone perception of light remains, but no color can be recognized.

From these observations Woinow is led to admit the existence of five different elements in the human retina—one, the rods, having for their function the perception of light alone; and four kinds of cones, each adapted to perceive a fundamental tint, red, yellow, green, or blue, but having very different distribution. In and near the center all are present, though even in this zone the red are most numerous about the center. In the second zone, in addition to the rods, only yellow and blue percipient cones are present. In the third zone the rods, or light perceiving elements, alone remain. The red and green perceiving elements appear to be very tender and delicate, and are first to fail in function when the eye is injured; the yellow and blue are more resistant. Klug makes a fourth zone within Woinow's red zone, in which only orange and violet are clearly perceptible.

What is Really Wanted.

It is not the stimulus of more money that is wanted to awaken once more the torpid and paralyzed energies of the nation.

This is a truism which it seems impossible any man of sense and reflection can deny.

Mere money is absolutely plenty everywhere. It can now be hired for four per cent per annum every day in the year.

If a carload of greenbacks was run into the center of any town in the country, and proclamation made that they could be had in any quantities to suit, by anybody and everybody who wanted to borrow, and who could give good security for their repayment, in what way would the present situation be improved? Would the proposition bring out a single customer, create one purchaser, or set one wheel of industry in motion? We know it would be of no more utility in reestablishing trade and prosperity in that town than the introduction of a carload of sawdust.

But if a solitary individual should come into one of our towns in the East or in the West, and offer to buy a hundred thousand dollars' worth of its products, whether corn, pork, iron, or calico, and have not one dollar in money, but only the note or bill of some good commercial house payable in six months, we all know a sudden spring would be given to the activity of the town, and idleness would be supplanted suddenly by occupation.

What is wanted, then, to start the wheels of trade is not more of cheap money, but purchasers and consumers. If Congress can do anything toward creating them, they will do something toward reviving business, employing the idle, and feeding the hungry.

But this can only be done by restoring confidence and establishing trade and finance on a fixed and unchangeable basis; and, above all, by being honest about it. This threatening to swindle and threatening to cheat, which we have heard of since Congress assembled in December, has a tendency to unsettle everything, and acts directly to the prejudice of every industry in the country. It operates as a constant oppression upon the producer, and upon the working man.—*N. Y. Sun.*

A Paper Exposition in Berlin.

An International Exposition of paper and paper making is to be held in Berlin, Germany, from July 16 to August 31 next. It will cover the whole field of paper making, involving machinery as well as finished product, and will extend to all branches of the stationery trade. The classification is in eight groups, respectively as follows: (1.) Fibers, chemicals, etc. (2.) Machinery for making and working paper and paper board. (3.) Paper and paper boards. (4.) Colored, embossed, and printed papers. (5.) Manufacture of paper and pasteboard. (6.) Paper for technical and mechanical purposes. (7.) Writing, drawing, and other papers for educational, commercial, and art purposes. (8.) History and literature of the paper industry.

Probably groups 5 and 6 will be exceedingly interesting, as an opportunity is here offered for making a complete collection of all the many objects to the manufacture of which paper is now devoted. It will include paper for roofing and sheathing, paper wheels, paper barrels, paper clothing, paper collars, and the many different wares of paper pulp. Exhibitors must give notice of their intention to participate before April 1, to the agent in this country, Mr. Howard Lockwood, publisher of the *Paper Trade Journal*, this city. A fee of $3·50 is required. Steam power is furnished free.

A Curious Explosion.

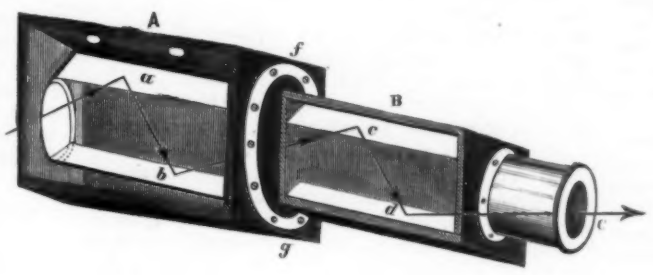
One of the most inexplicable explosions took place recently, at the Pine Iron Works, in Montgomery county, Pa., when a teamster tipped a cart load of hot cinders into a snow bank. This apparently innocent action produced an explosion which is described as "fearful." Houses a hundred yards away were shaken, and persons near by burned and cut by flying cinders.

A DOG-FISH weighing 2,500 lbs. was recently captured on the coast of France.

THE HELIOSCOPE.

BY DR. L. HILLE.

Sun spots and solar protuberances were formerly observed with instruments called sun glasses, which were made of double glasses, the intermediate space being filled with light-absorbing liquids. Good sun glasses, however, were seldom to be had, because in too many cases the expansion of the liquid, on being heated by the solar rays, would break the glasses. There were also other difficulties. Herr Merz, of Munich, has constructed a helioscope which is free from these drawbacks, and which is based on the law of polarization of light. If a ray of light strikes at an angle of 35° 25′ on a mirror which is mounted so that it may be turned on its axis, and the reflected ray is thrown on a second mirror placed at right angles to the first, the light is polarized. The polarized ray is perfectly bright if the two mirrors are parallel, but it becomes more and more faint when the upper mirror is turned, until at a right angle it disappears altogether, so that the field of vision in the second mirror is perfectly dark.



THE HELIOSCOPE.

In the two cases, A and B, of the apparatus are mounted four heavy mirror glasses, *a*, *b*, *c*, and *d*. The case, A, is screwed to the telescope through which the sun is to be observed. The light falls on the first mirror at an angle of 35° 25′, and is reflected to the second, from whence, by means of the mirrors, *c* and *d*, in the case, B, it reaches the eye of the observer at C.

To effect the necessary diminution of the sun's light, the case, B, is arranged so that it may be turned around the axis of the apparatus by the ring, *f g*. When the mirrors in case, B, are parallel to those in A, the image of the sun appears perfectly white, but the light can easily be diminished to any desired degree by simply turning the case, B, which can be done without removing the eye from the ocular lens.

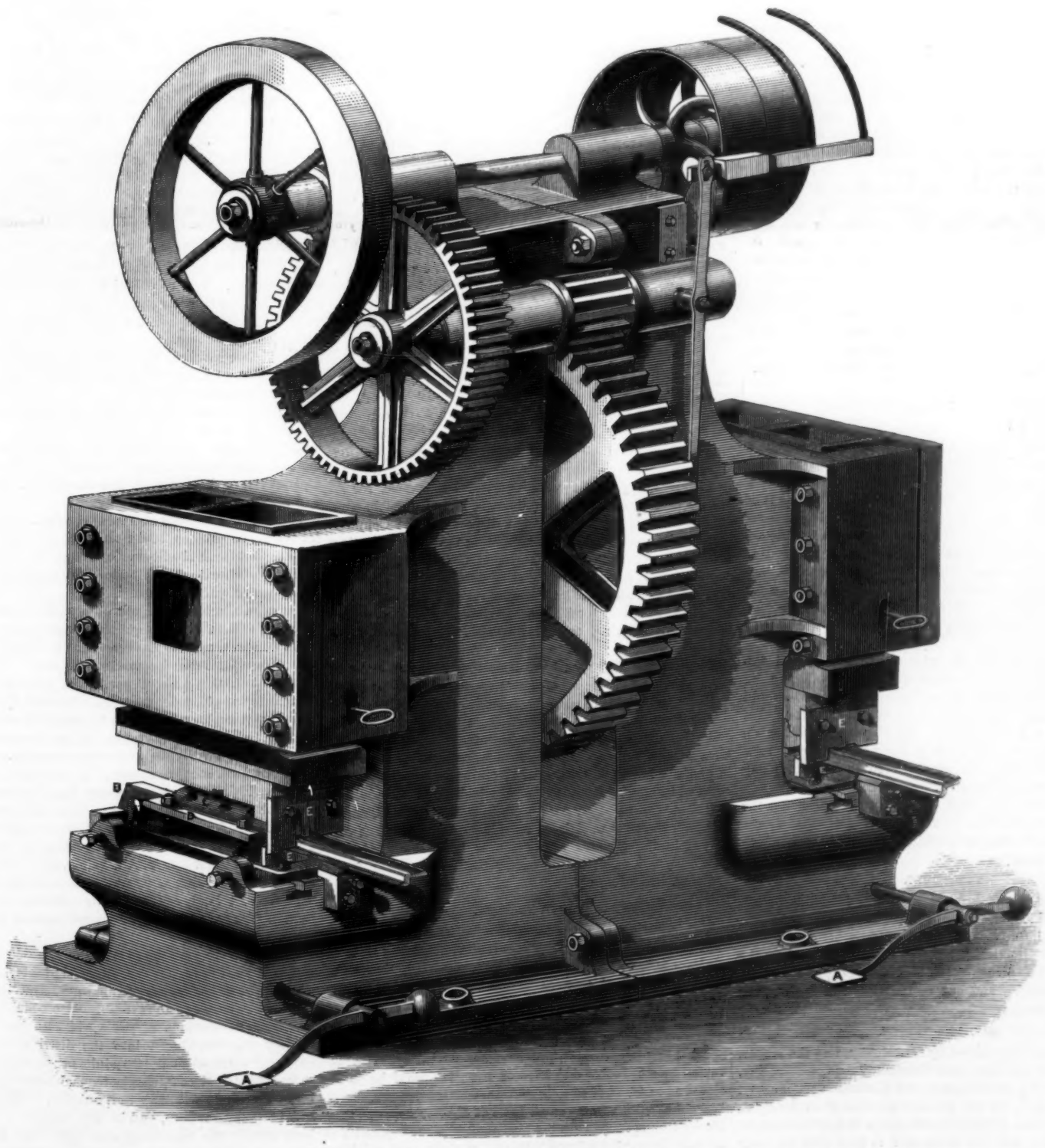
To prevent the air in the apparatus from becoming heated too much, the upper side of the case, A, is provided with a couple of holes for ventilation. The instrument has been found by practical use to be of great merit and easy of manipulation, and it is therefore expected that it will soon be one of the implements of every observatory and scientific academy.

PUNCHING AND SHEARING MACHINE.

A very substantial double shearing, punching, and straightening machine has been constructed by Messrs. Wagner & Company, Werkzeugmaschinen Fabrik, Dortmund, Germany, for the Union Company's Iron and Steel Works, at Dortmund. The machine, which weighs about 15 tons, was constructed for shearing, punching, and straightening steel fish plates of any desired length, and of a thickness up to 0·9 inch, and with holes up to 1·18 inch diameter. The bars from which the fish plates are made are brought to the machine in a red hot state, and the fish plates are completely finished by the machine, nothing further being required than to dress off the burr left by the punching. Each side finishes ten fish plates per minute. The machine, shown in the illustration (which we copy from *Engineering*), is placed directly in front of the rolls, the bars leaving the finishing grooves of the latter passing over guide rollers to the machine. The first operation performed by the latter is the cutting off of the uneven end of the bar. The attendant then presses his foot on the lever, A, thereby bringing the bar against the stop, B, and fixing the length of the fish plate; the shears, E, then cut the plate to length, and the four or six punches, C, punch the bolt holes. At the same time the block, D, descends and straightens the fish plate. When the punches and shears perform their upward stroke, the finished fish plate remains on the machine until the foot lever, A, is released, when the stop, B, is moved out of the way, and the bar being thrust forward, the finished fish plate is cleared away.

The combination of the three operations of punching, shearing, and straightening has the advantage of substituting one machine for two and dispensing with two men, only three being employed instead of five as usual. The machine also turns out its work very quickly, and it is of good and strong design.

IN 1874, M. Paulet enumerated no less than 173 different processes and apparatus for preserving wood, which had been patented or described in scientific works since 1700. During the past three years the list has been largely augmented.



DOUBLE SHEARING, PUNCHING AND STRAIGHTENING MACHINE.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

It has been reported around this city and telegraphed to other places that another appropriation had been asked for by the Commissioner of Patents to complete the restoration of the burnt models. Information from headquarters, however, contradicts this, and it is stated that, so far from a new appropriation being required, it is believed that the present one will be sufficient to restore all the models that are really worth the trouble.

It may be interesting to your readers to know the means adopted in restoring the models, as there are no doubt tens of thousands of them who have models in the office. Most of this work of restoring models is done in the North Hall, one that was formerly considered the finest of the four halls forming the model museum. It was the last wing of the Patent Office finished, and probably furnished a resting place to many of your soldier readers, for it was used as a hospital during the war, and just before it was fitted up to receive the models it was used for the Inauguration Ball at Lincoln's second inauguration, so that it has seen gay times as well as sad ones. At the present time it presents the appearance of a huge machine shop, except that comparatively little machinery is employed, which consists mostly of small lathes run by foot power, and two or three portable forges. The models are first picked out of what appears to be heaps of scraps, and arranged as near as possible in the classes to which they belong, the location in which they are found being in many cases the only clew to the class. The examiners in each class them compare the models with the drawings which accompanied them when originally filed, and affix a card to each giving the name of the inventor, the date of the patent, and the name of the invention. The model is then entered in a book, with a description of its appearance and condition, and is then passed to the laborers for cleaning. The first operation is to pickle it in a solution of sulphuric acid to eat out the rust and dirt, and then wash it in a bath of lime water to counteract the acid left on its removal from the pickling tank, after which it is dried with sawdust. Then, if needed, the model is put to soak in a bath of kerosene oil to loosen the screws and such other adhering parts as could not otherwise be readily started, and after draining it is passed to a machinist, who now cleans, refits, and repairs it as far as possible or allowable. In many cases the model has simply been bent out of shape by the heat, and it is then taken to pieces and the bent parts straightened by the aid of the portable forges. If any part is missing search is made for it among the miscellaneous mass of pieces, and when found it is replaced in proper position. In many cases small parts are made and added to the model to make it complete, which parts, however, are always made to correspond exactly with the drawing. The model is then taken back to the bookkeeper, who enters it upon his register the second time, with a description of the part that has been added, and the model is then transferred to temporary cases in the West Hall, looking in many cases better than it did when originally filed.

PATENT MATTERS BEFORE CONGRESS.

A bill has been introduced into the Senate by Mr. Johnston enacting that in all cases where patents have been passed and allowed since July 8, 1870, but have been and are still withheld by having been declared forfeited under section 4885 of the Revised Statutes, because of the non-payment of the final fee within the time prescribed, the Commissioner of Patents, upon payment of such final fee within six months after the passage of the Act, shall issue the said patents as if the final fee had been paid within the time heretofore prescribed by law; but no person is to be held responsible for infringement for having used or made any articles previous to the issuing of such patents for which any patent may issue under the Act.

Mr. Pridemore, of Virginia, who some weeks since introduced a bill to amend (?) the patent laws, so that patents upon agricultural, horticultural, and mechanical implements should only run for eight years and not be extended beyond that term, has had a hearing before the House Committee on Patents, in which he held forth in favor of the eight years' limit to patents, but it is not believed that there is any probability of such bill passing.

A bill has been introduced by Mr. Dwight, allowing the Commissioner of Patents to extend the patent of Edgar Huson, for wagon gearing, dated February 17, 1857, which has already been once extended.

TORPEDOES.

Mr. McPherson has introduced a bill into the Senate appropriating $250,000 for experiments with and for the purchase of an improved movable torpedo, after competitive trials under the direction of a board, to be designated by the President, of two officers of the Ordnance Corps, two of the Corps of Engineers, and one of the Board of Supervising Inspectors of steam vessels.

MEMPHIS BRIDGE.

A bill has been introduced by Mr. Money, into the House, authorizing the Arkansas and Tennessee Bridge Company, and the Tennessee Construction and Contracting Company, to erect a bridge over the Mississippi river from Memphis to Hopefield, Ark., having one unbroken or continuous span of not less than 500 feet from pier to pier over the main channel, and to be so built as not to interfere with the free navigation of the river. If preferred, however, the companies are to have the privilege of constructing a tubular bridge through the waters of the river, or a tunnel thereunder, provided that the same does not interfere with the navigation of the river.

CANAL THROUGH THE ROCKY MOUNTAINS.

Mr. Grover has introduced into the Senate a bill authorizing the survey of a water route from the Atlantic to the Pacific, which provides that the Secretary of War shall appoint two commissions, each to consist of three officers of the Engineer Corps of the Army, and three Civil Engineers, who shall survey a route and mature plans for uniting the Missouri with the Columbia river, by the construction of one or more canals connecting any of the affluents of the two rivers. A second section authorizes the President to enter into a negotiation with the government of Great Britain and British America, for the free navigation of the Saskatchewan and such portions of the Columbia river as may run within British territory. By a third section an appropriation of $50,000 is made for the expenses of the commissions.

COTTON WORMS AND GRASSHOPPERS.

The House Committee on Agriculture has agreed to report favorably, with some amendments, Mr. Shelley's cotton worm bill, which provides for the appointment, by the Commissioner of Agriculture, of a commission to inquire into the origin of the cotton worm trouble, and, if possible, suggest a remedy.

The same committee has under consideration an application from the people of Taos County, New Mexico, for assistance on account of their sufferings from the grasshopper plague.

In connection with this subject it may be stated that an elaborate and carefully prepared report has been submitted to the Secretary of the Interior by the Entomological Commission, containing a mass of facts respecting the migration and habits of grasshoppers, whose ravages have for several years caused so much loss to the western farmer. It would appear from the report that it is not beyond the scope of human ingenuity to restrict the ravages of this pest, and that their absolute destruction may possibly be accomplished. The area subject to the devastations of the grasshoppers is estimated at upwards of 1,500,000 square miles west of the Mississippi, and extending northwesterly into British America. There has been some correspondence with the Dominion Government looking to coöperation with us in the continuation of these investigations, but nothing definite will be done by that government until it is known whether Congress will appropriate sufficient funds to continue the Commission. The Commission also suggests an extension of their labors into the field of operations of the cotton worm, which, it is said, causes the loss of not less than $20,000,000 annually. If the Commission is continued it expects to be able to render valuable aid to the country by its researches into the nativity and habits of, and its suggestions as to the best modes of fighting, the insect pests of both south and west

THE PARIS EXPOSITION.

Every month or so a report is started in this city that on account of war complications the Paris Exposition will be postponed, and the report is telegraphed all over the country. This has just occurred again for the fourth or fifth time, and the report, as usual, on due inquiry at headquarters, is found to be without foundation. In the meantime preparations are rapidly going on at the Agricultural Department for as full a representation of our products, etc., as possible with the limited time and money at the disposal of the Commissioner. He has issued a circular stating that he is collecting and preparing suitable specimens of the agricultural productions of the several States and Territories of the Union for exhibition at Paris, and he therefore solicits from any source specimens of native fertilizing materials, vegetable products of every description, and of materials manufactured from such products.

Encouraging responses have been received from many of the States, and specimens of their productions are now being received, and other contributions are in preparation.

The Department has prepared from material on hand a collection of sections of the woods of our forest trees that have an established commercial valuation, a series of models in plaster of typical specimens of fruit and vegetables, and cases of insects injurious to the principal crops. In addition to this a collection of native wools is to be formed, and a series of working models of machinery and apparatus employed in the growing and utilizing of agricultural products, plans for illustrating our methods of farming, fruit-growing, irrigation, etc., are to form part of the exhibit.

FLOUR BY MAIL.

The following clipping from the *National Union* of this city, besides giving a pretty accurate view of the state of affairs connected with sending flour by mail, shows the effect and value of a notice in the SCIENTIFIC AMERICAN:

"The announcement in the last issue of the SCIENTIFIC AMERICAN that the Post Office Department had under consideration the matter of permitting 'flour' being sent in the mails at third-class rates, provided any device could be invented by which that and kindred material could be so inclosed as to admit of examination without danger of leakage, has waked up inventors in all parts of the country, and they are sending specimens to the Department in such quantity as actually to prevent acknowledgment of their receipt. Most of these inventions are neither new, practicable, nor desirable, and but few of them are deemed worthy to be tested. The principal idea is to make a box or package in which flour can be inclosed in such a way that the postmaster where it is deposited for transmission may be able to ascertain what is contained therein without breaking it open or otherwise disturbing the contents, whereby they would be sifted out in the mail pouches, to the injury of the mails; and few have yet come within hailing distance of an acceptable arrangement to that end. In the meantime, the Post Office Department languishes under the accumulated weight and number of the contrivances presented, the most practical of all which is a little wooden box, with a mica tag fastened in with putty, which in the corner of a heavy mail pouch would last about half a moment under the rough handling to which the mails are subjected."

MAKING IRON AT THE NAVY YARD.

As previously announced, experiments have been making as to the probability of successfully and economically manufacturing iron at the Navy Yard, in this city. It is now announced as the result of these experiments that it has been demonstrated that the Government can economically manufacture its own iron here, from whence it can be shipped to the various navy yards as wanted. It has been ascertained, it is said, that the necessary adaptations for the purpose can be made in our Navy Yard for about $10,000, and that Government can save that sum in one year by manufacturing its own iron from the accumulated scrap. It is thought that if this work is once started it would extend so as to embrace the making of iron from the ore, as we have direct and cheap water communication with coal and iron localities in Maryland and Virginia.

OCCASIONAL.

Washington, D. C.

Tea Culture.

To the Editor of the Scientific American:

In looking over a file of American papers the other day, I came across an article headed "American Tea," taken from the Philadelphia *Press*. The article went on to state that "cultivation of tea will speedily be proceeded with in the New World, and the Pacific section of America is probably destined to be the great tea producing country of the future, and thus solve the vexed question of Chinese labor on the Pacific coast."

I need not say with what deep interest I read the above, being a tea planter myself, and interested in a movement just started for introducing Indian teas to the American public. But why should not America grow her own tea? And in answer to that question I beg leave to make the following remarks on the suitableness of America as a tea growing country:

In fixing on any district to plant tea in four things have to be considered, namely, soil, climate, labor, and means of transportation. Tea, especially the China variety, will grow in very varying climates and soils; but it will not flourish in all of them, and if it does not flourish, and flourish well, it will certainly not pay.

The climate required for tea is a hot, damp one. The rainfall should not be less than 70 to 90 inches per annum, and the more of this that falls in the early part of the year the better; any climate suffering from drought in the early part of the year is not so good as one where the rain is more equally diffused. All tea districts would yield better with more rain in February, March, and April, and therefore where fogs prevail in the mornings at the early part of the year are so far benefited.

The less cold weather experienced where tea is, the better for the plant. It can stand and will grow in great cold; but I do not think it will ever be grown to a profit on such sites. The climate cannot be too hot for tea if the heat is accompanied with moisture.

Tea grown in temperate climates, such as moderate elevations in the Himalayas, is quite different to the tea of hot, moist climates, such as Eastern Bengal. It is much weaker and of very little use for mixing purposes. On the other hand, the Indian teas of hot, moist climates have great value for strength and pungency. Another important point in fixing on a climate for tea is the fact that apart from the strength the yield is doubled in hot, moist climates to what it is in comparatively dry and temperate ones.

Sloping land is objectionable. It cannot be highly cultivated, and high cultivation means large outturn. Of flat lands there are two kinds suitable for tea, table and valley land; the former is very rare in the tea districts of India. The best valleys are those with a gentle slope both ways, one toward the lowest line of the valley, the other toward the mouth, thus making a natural drainage during the rainy season. Flat lands can be highly cultivated; steep slopes cannot. Tea pays best with high cultivation; *ergo*, flat lands are preferable.

That there are portions of America suitable for the cultivation of tea I have not the slightest doubt, and, provided labor could be had at moderate rates, America would in a very few years compete favorably with China and Japan in supplying the markets of the world with tea. Before machinery was introduced into the districts of Assam and Cachar it required about two adults per acre to work gardens successfully; but now, thanks to machinery (and none of the best), we can do with half that number. Machinery is yet in its infancy out here, and in this respect America would have greatly the advantage over China and India; her resources being unlimited as regards intelligence, means of transport, and mechanical appliances. And these are what we

lack out here—machinery none of the best, and worked with the greatest difficulty, transportation of the most primitive kind and very slow, and, however noted the Hindoo may be for mildness of disposition, he cannot plead guilty to a very large share of intelligence.

Supposing that a suitable climate was found in America for the cultivation of the tea plant, easy access to the European markets, cheap and rapid means of transportation, unlimited mechanical appliances, would enable the planter to offer the public a better and cheaper article than they now receive from China and Japan, and as an enterprise would offer a safe and profitable investment for the money.

Varieties of the tea plant are many, but they all arise from two species, the China plant, the common tea plant of China, and the indigenous plant first discovered some forty years ago in Assam.

These are quite different species of the same plant, and how produced, by climate, by soil, or in what way, no one knows. But they do differ in every respect. The indigenous tea grows quicker than the China if it has not been overpruned or overplucked. In other words, it flushes quickly, for flushing is growing. The indigenous does not run as much to wood as the China. The indigenous tea has a leaf of nine inches long; the leaf of the China bush never exceeds four inches. The indigenous leaf is a bright pale green, the China leaf a dull dark green color. The indigenous "flushes," that is, produces new leaf, much more copiously than the China, and this in two ways: first, the leaves themselves are larger, and thus if only even in number exceed in bulk what the China has given; and secondly, it flushes oftener.

The infusion of tea made from the indigenous species is far more "rasping" and "pungent" than what the China plant can give, and the tea commands a much higher price in the English market.

I have now, I think, pointed out the leading characteristics of the two original varieties of the tea plant, and it stands to reason no one would grow China who could get indigenous. But the truth is, a pure specimen of either is rare. The plants between indigenous and China are called "hybrids." They were in the first place produced by the inoculution when close together of the pollen of one kind into the flower of the other, and the result was a "hybrid," partaking equally of indigenous and China characteristics, and has proved itself and is acknowledged by all planters to be the best class of plant for gardens.

It is evident, then, that the value of a garden depends much on the class of its plants, and that a wise man will only propagate the best. Only the seed from good varieties should be selected, and when this shall have been systematically done the yield per acre will far exceed anything yet realized or even thought of.

The American government should follow the example of the English government by establishing an experimental plantation in the most favorable locality, and under the management of an experienced planter who would insure the best possible results. Who can tell what great results a few years might bring about?

The following is about what it costs to put out 200 acres in this district, and the estimate leaves a wide margin to go on:

Total expenditure, first year	$18,000
" " second year	12,000
" " third year	9,000
	$39,000
Outturn the 2d and 3d year. 170 lbs. per acre, at 40c. per lb., 34,000 lbs.	13,600
Balance	$25,400
Working expenses for 4th year	12,000
	$37,400
Outturn the 4th year, 320 lbs. per acre, 64,000 lbs., at 40c	24,600
	$12,800
Working expenses 5th year	10,000
	$22,800
Outturn the 5th year, 400 lbs. per acre, 80,000 lbs., at 40c. per lb	32,800

At the end of the fifth year all invested capital is paid up, $9,200 profit, and the possession of tea property worth at least $80,000.

The above is a very fair estimate of the working of a garden in Cachar, and I believe it could be done for less in America, providing the climate was suitable.

Trusting you will pardon me for trespassing on your valuable space, yours faithfully,

JAMES L. FORBES.

Burtall Tea Garden, Luckiepore, Cachar, Eastern Bengal, East India, January 10, 1878.

Origin of the Potato Disease.

To the Editor of the Scientific American:

By recent discoveries of some English scientists so commonplace a subject as the potato disease has been brought into prominence as an element of scientific importance, and would seem to be a genuine *bête noir* in the discussion of the question of "spontaneous generation," now so sharply dividing the ablest of our scientific investigators and writers.

When the potato disease first made its appearance in Ireland, and occasioned a famine by its rapid destruction of this favorite esculent, it was the popular belief that the plant, by long and forced cultivation, had exhausted its vitality, and a fresh start would have to be made with seed from the region where the plant is known to be indigenous. The belief that the plant had run its course, or completed the cycle of its life, was strengthened by the failure of the crop from the same cause in countries remote from the region first infected.

The mystery, however, which enveloped the nature and cause of the disease was eventually dispelled by the researches of distinguished scientists, who discovered and described the fungus, *Peronospora infestans*, which is the germ of the disease. The rapid spread of the disease over the country where it seems to have originated, its following the channels of commerce, and almost simultaneous appearance in every civilized country of the world, are also satisfactorily accounted for in the well understood vitality and subtle diffusion of the zoöspores thrown off into the atmosphere by this destructive fungus. The discovery of the fungus proved the fallacy of the popular theory, and destroyed the hope of resuscitating the plant from its original source of production, leaving science to cope with the disease itself.

But the origin of the disease is still veiled in mystery, and is a question open to much debate; especially when the existence of this fungus is made the basis of an argument in elucidating the doctrine of evolution of animals and plants, to prove that the forces which brought created matter into existence countless ages ago are still acting and forming new creations.

From this point of view the question of the true origin of the fungus becomes one of great speculative interest, and when associated with the doctrine of "spontaneous generation," of vital importance in the great modern antagonism of science and the Scriptures.

A late number of Hardwicke's *Science Gossip*, an English journal deservedly in favor with students and lovers of nature on this side of the Atlantic, contains the gist of a paper recently read before a learned society by Mr. Worthington Smith, in which he describes a remarkable fossil fungus belonging to the genus *Peronospora*, discovered by him, ramifying through the vascular structure of a *Lepidodendron*, one of the huge club-mosses of the Carboniferous epoch. This fossil fungus Mr. Smith names *Peronosporites antiquarius*, and regards it as perhaps the oldest fungus on record.

The paper is illustrated with microscopical views, enlarged to four hundred diameters, and showing with remarkable clearness the organization of the fossil oögonia (or zoösporangia), with the differentiation of the protoplasm into zoöspores as distinctly defined as in any living specimens of the present time; "and," says the writer, "the wonderful fact becomes manifest that the bladder is exactly the same in size and character with the average oögonia of the present day, especially with the same organisms belonging to *Peronospora infestans* when measured to the ten thousandth part of an inch. The average number of zoöspores in each oögonium is also the same. The organisms are apparently identical."

From the close alliance of the peronosporæ to the algæ, Mr. Smith infers the extreme antiquity of the *Peronosporites antiquarius*, and is inclined to place it among the primeval plants from which fungi and all other cellular cryptogams have branched.

The countless ages which have passed since this primordial fungus was mummified in the Carboniferous rocks, and the sudden appearance of the fungus in this age of the world, selecting for its habitat a plant that for three centuries has been under the constant surveillance of mankind, with all the logical inferences to be derived from this wonderful demonstration of nature, would seem to dwarf into absolute insignificance the recent experiments of Professor Tyndall, which lack the necessary element of time and the "environments" favoring a natural selection, which are concomitants of this greater experiment of Nature herself. Unless the wide gulf which separates our times from a geological period so remote that the "century" seems inadequate as a unit of measure, can be so bridged over as to show a reasonable possibility of regular descent, the burthen of the argument from which Professor Tyndall's neat and beautiful experiments were complacently supposed to have relieved the opponents of the doctrine of "spontaneous generation" still remains with them, and the conclusion of Mr. Worthington Smith stands unrefuted, "that the law which called the peronosporites into existence countless ages ago is in force now, and that this law produces the same results now as then."

J. W. PAGE.

Power Required to Run a Velocipede.

To the Editor of the Scientific American:

In your issue of February 9th G. O. A. asks: "Is there a practical bicycle made at present—that is, one which would enable a man of ordinary muscular development to travel a distance of 20 miles on a good country road in less time and with less fatigue than he could do it on foot?"

For some years past it has been necessary for me to use a velocipede as my only means of locomotion, and under the conditions asked by the above inquirer. I therefore do not hesitate to say that, on the strength of my practical experience, it is impossible to run a velocipede over a given distance in a given time with less expenditure of power than it would be to walk the distance in a given time.

In fact, under the most favorable circumstances, it is impossible to run a velocipede through a given distance with the same expenditure of power as that required to walk the given distance.

Who is it that would fail to see the absurdity of a person who on walking along a road had hitched himself (horse fashion) to a velocipede, with the vain idea that by drawing the vehicle after him he could more easily accomplish his journey? Certainly in the above instance he would have a better mechanical advantage than if he sat upon the machine and propelled himself, because the weight of his person would increase the friction of its moving parts.

Persons who perform great feats on velocipedes must practice continually, in order to keep their muscular powers trained up to the proper degree, as the force necessary to this end is greater than that required by the ordinary pedestrian.

JNO. B.

Antoine Cæsar Becquerel.

M. Antoine Cæsar Becquerel, the distinguished French physicist, recently died at the advanced age of ninety years. The cause of the electric currents which originate in the voltaic battery was unknown until Becquerel, by a series of brilliant researches, revealed the reason. He demonstrated that in the contact of the two metals there was no electricity disengaged, except in proportion to chemical action, friction, or difference in temperature; and on the other hand, he showed that electricity was produced in all chemical reactions, and especially in the action of acid on metal, the positive current passing on the metal and the negative in the acid. By investigating the chemical effects produced by the action of electric currents, even the weakest, M. Becquerel connected under the name of electro-chemistry a series of new phenomena, and showed the action of these in causing substances to be decomposed, combined, transported, crystallized, or made to produce brilliant colors used industrially.

During his study of thermo-electric phenomena, M. Becquerel invented the electric thermometer. By this instrument it is possible to determine at a distance the temperature of the interior parts of animals and vegetables, of the earth, or of the higher regions of the atmosphere. He also invented the differential galvanometer and the electro-magnetic balance. His more recent investigations relate to meteorological subjects and to certain curious electric phenomena, little understood, which occur in capillary spaces.

Henri Victor Regnault.

M. Henri Victor Regnault died in Paris, France, on January 19 last, at the age of sixty-seven years. M. Jamin sketches his life work, and pays a tribute to his memory in the following terms: "Regnault," he says, "collected all the fruits of the improvements he introduced into experimental art. Dulong before him had only perceived great general laws, and had not carried approximation far enough to discover their perturbations. Gases are not equally compressible; they do not dilate in equal ratios. Each has its individuality, and while all approach an ideal type expressed by Mariotte's law, none follow it absolutely. Regnault predicted that insufficiency of pressure was the sole obstacle to the liquefaction of oxygen and nitrogen, and that hydrogen itself, if it were cooled, would be capable of great compression and would liquefy. As Regnault advanced in his studies upon heat, difficulties multiplied. His researches in specific heat extend to all chemical bodies, simple and compound, solid, liquid, or gaseous, and Dulong's law came out victorious after the long test. The question of specific heat, already vast and difficult in its relation to solids and liquids, becomes still more complicated in relation to gases. The latter may be heated without change of pressure or volume, and in each case admit a different specific heat. Moreover, the relation of these heats is connected with the velocity of sound. Hence the utility may be conceived of measuring at once both these specific heats and the velocity of sound. It was necessary to do this for all gases, an immense work which Regnault did not hesitate to undertake, despite a severe accident which rendered the task the more difficult. He accomplished his undertaking, but was left with enfeebled mind—paying the penalty of overworked genius, as Newton and Pascal had done before.

"Regnault took little part in the advancement of the modern thermo-dynamical theory, for his labors rarely proceeded beyond the limit of experiment. Nevertheless, through his work the great theory has obtained many of its strongest arguments. It is the crowning of the edifice, and it appears that in that, scientific progress has been directed by a providential logic which first collected and classified facts, the causes of which were afterwards sought for. This classification was Regnault's life work."

Father Secchi.

Father Pietro Angelo Secchi, one of the most noted and successful of European astronomers, died in Rome on February 26. Father Secchi was born in 1818, and in 1850 became director of the Observatory of the Roman College. Here he invented a plan of meteorological observations, completed a survey of the Papal States, and conducted a water supply into Rome. He was the author of numerous valuable astronomical works, and was specially distinguished for his discoveries in spectroscopic analysis and in solar and stellar physics.

Claude Bernard.

M. Claude Bernard, who died on February 10, was one of the most famous of modern physiologists. He was the first who fully demonstrated the processes of digestion, and proved that the pancreatic juice is the agent which digests fatty substances; and that the blood on entering the liver possesses no sugar, but has an abundance on leaving it, a discovery since turned to great account in the treatment of diabetes. He died at the age of sixty-five years.

A NEW BOAT PROPELLING DEVICE.

In the accompanying engraving is illustrated a new device for propelling boats, patented through the Scientific American Patent Agency, January 8, 1878, by Mr. Thomas Fetherston, of Orange, N. J. It consists of a double crank shaft, supported in suitable bearings near the stern, and operating, by a large bevel wheel, a bevel pinion at the end of a jointed propeller shaft. Crank disks at the ends of the double crank shafts are connected by lever rods, with pivoted hand levers, which are worked by the occupants of the boat, who sit as shown facing the bow. Oars are of course dispensed with, and the simplicity of the device enables one person, if need be, both to propel and steer the boat.

NEW BOAT-PROPELLING DEVICE.

Curious Insect Instinct.

Dr. Dewitz, a German naturalist, has recently described a very remarkable case of insect instinct peculiar to a butterfly of the genus *Aïdos*, indigenous to Venezuela. The chrysalis on casual examination seems to be perfectly empty, while its surface is punctured with numerous holes. Closer scrutiny shows that, in reality, there is a double envelope, the outer layer alone of which is perforated, while on the inner covering are deep pits corresponding with the apertures. The caterpillar, after making the outer cocoon, perforates it, and then makes a strong inner one in which it takes refuge, the object of the holes being obviously to cause the cocoon to appear untenanted.

PHILLIPS' IMPROVED BUCKBOARD WAGON.

We illustrate herewith a new thorough brace or spring buckboard and light road wagon, for which it is claimed that it possesses all the advantages of a thorough brace and spring buckboard, owing to the springs front and rear. It is of light draught; there is less friction on wheels, axles, king bolts, and shaft shackles; it is noiseless, moves with less jar over rough roads, has shorter gearing for the length of platform or buckboard the latter may be adjusted by variable leather or metal shackles, and the general construction is inexpensive and durable.

Just above the forward axle is the bolster, A, which is connected by the side bars, B, with the rear axle. The point of attachment with the latter is strengthened by braces, C, and at a short distance back of the bolster the side bars are still further stiffened by the cross bar, D, from the center of which a secondary reach connects it with the center of the crosshead. Depending from the lower side of this short reach is the metal brace, E, which passes beneath the axle. Above the bolster, A, is the long C-shaped spring, F, through the center of which passes the king bolt. At the rear, half C-springs, G, are mounted on the side bars over the rear axle. From the upper ends of both springs are hung by shackles the cross bars, to which, as bed pieces, are secured the boards forming the platform of the vehicle. The rear support of this platform may be (by means of straps) thorough braces passing over the outside of springs, G, and looped down from their upper extremities around the outer ends of the back cross bar; or the said bar may be suspended from the ends of the thorough-brace by metal shackles. Patented August 7, 1877. For further information address the inventor, Mr. James L. Phillips, Lowville, Lewis county, N. Y.

PHILLIPS' IMPROVED BUCKBOARD WAGON.

MILLINGTON'S HYDRAULIC RAM.

Our engraving represents a new hydraulic ram of simple construction, which needs no detailed explanation. The advantages claimed are as follows: The water flows into the machine, and strikes both the impetus valves in a smooth unbroken plane horizontally, thereby avoiding the friction and reaction of the perpendicular ram. The two cylinders enable one source to furnish water at two places simultaneously by pipes from each cylinder. There are no brass or iron faces to wear. There are but two working parts, each faced with a leather covering which can be quickly replaced whenever necessary. A regulating thumbscrew is provided whereby the amount of water used or wasted can be regulated, and a speed of from 30 to 120 strokes per minute obtained at will. The parts of the machine are keyed together, so that screws and bolts are thus dispensed with, rendering their setting up an easy matter.

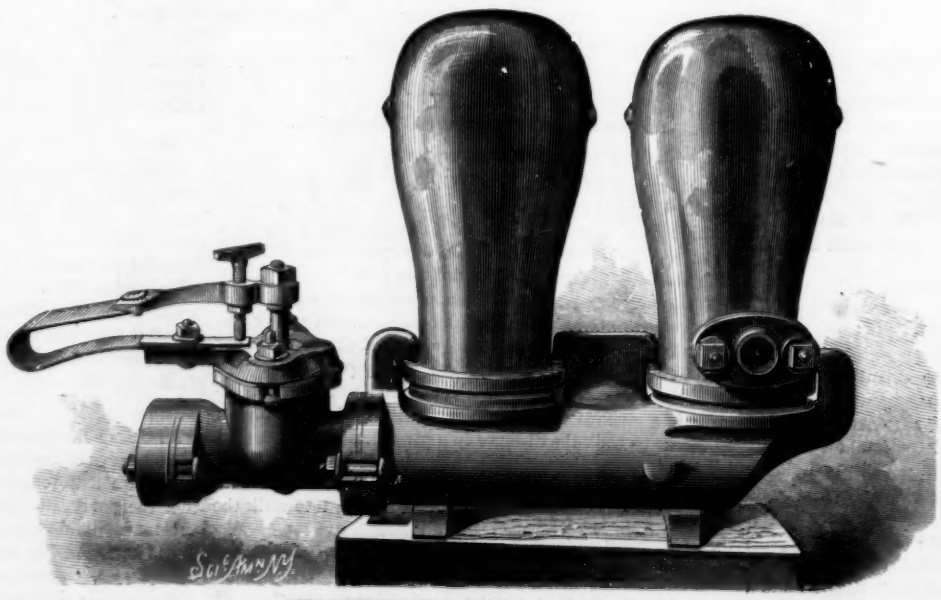
The ram can be used, we are informed, on any fall of water, from sixteen inches upwards, and is guaranteed to convey one fifth of the water passing into it, a distance of one hundred rods, and to discharge it at an elevation twelve times higher than that existing between source and machine. Or a greater percentage of water can be raised to a less height. The apparatus is in successful use in many localities, and is especially adapted for use on farms, or in cities for elevating water to the top of high buildings.

Patented January 22, 1878. For further particulars as to sale of rams, patent, or territory, address Mr. J. F. Frueauff, agent, Columbia, Lancaster county, Pa.

A Kangaroo Invasion.

The Melbourne *Argus* reports a remarkable invasion of kangaroos in Queensland, Australia. It appears that the drought of last summer, and the decreased food supply in consequence thereof, has driven the animals from the unsettled bush and caused them to descend in thousands upon the inhabited regions, devouring the crops and stripping the country of vegetation, so that the colonists have had to resort to dry leaves as fodder for their cattle. The settlers have organized large expeditions to meet the invasion, and within four days it is said that upwards of 4,000 kangaroos were killed. The flesh, which is excellent eating, is being packed in tins and shipped to England.

To CLEAN greasy beakers and photographic glass plates, Dr. Walz suggests the use of an aqueous solution of permanganate of potash, to which a few drops of hydrochloric acid are added. The solution may be saved and used repeatedly, until its oxidizing power is exhausted.



MILLINGTON'S HYDRAULIC RAM.

New Process of Labeling Plugs of Tobacco.

About three years ago letters patent were granted for processes of labeling plugs of tobacco, by the use of labels made of tin or like hard substance, and attached to the plugs of tobacco by means of pressure applied to the label; thus pressing the label on to or into the plugs of tobacco.

Large quantities of plug tobacco, so labeled, have been sold, and such a demand has been created for labeled plugs that the trade and consumers call for tobacco with metal labels attached to the plugs, as we are informed, to the exclusion of nearly all plugs of tobacco which are not, in some way, labeled. Until recently, there seemed to be no way for attaching labels to plugs of tobacco, unless the label was made of some hard substance and applied by means of pressure.

By letters patent granted Hiram W. Hunt February 5, 1878, a new departure has been made in the art of labeling plugs of tobacco. During the process of manufacture, or after the plugs are made, depressions or cavities may be produced in the plugs in numerous ways, by means of dies or suitable devices, suitably applied to the lumps or plugs. A label, which may be made of hard or soft metal, or any other suitable material, and of form and size adapted to fill the depression, is then placed in each of the cavities or depressions so formed. After the labels are thus placed in the cavities or depressions, and the packing boxes filled and closed, the elastic, spongy character of freshly made plugs of tobacco causes the depressions or cavities to contract, fill, and partially close in and upon the sides and edges of the labels, so that when the boxes are opened the labels are found to be securely attached to and held in the cavities or depressions in the plugs. It is claimed that the distinguishing features which make this invention radically different from other processes of labeling plugs of tobacco are: It overcomes all necessity for pressing the labels on to or into the plugs; the application of pressure to or upon the label is thus overcome, as well as the necessity for using labels made of hard substances. Thus it seems that a novel, easy, practical, and inexpensive way has been found to label plugs of tobacco.

Smoking while at Work.

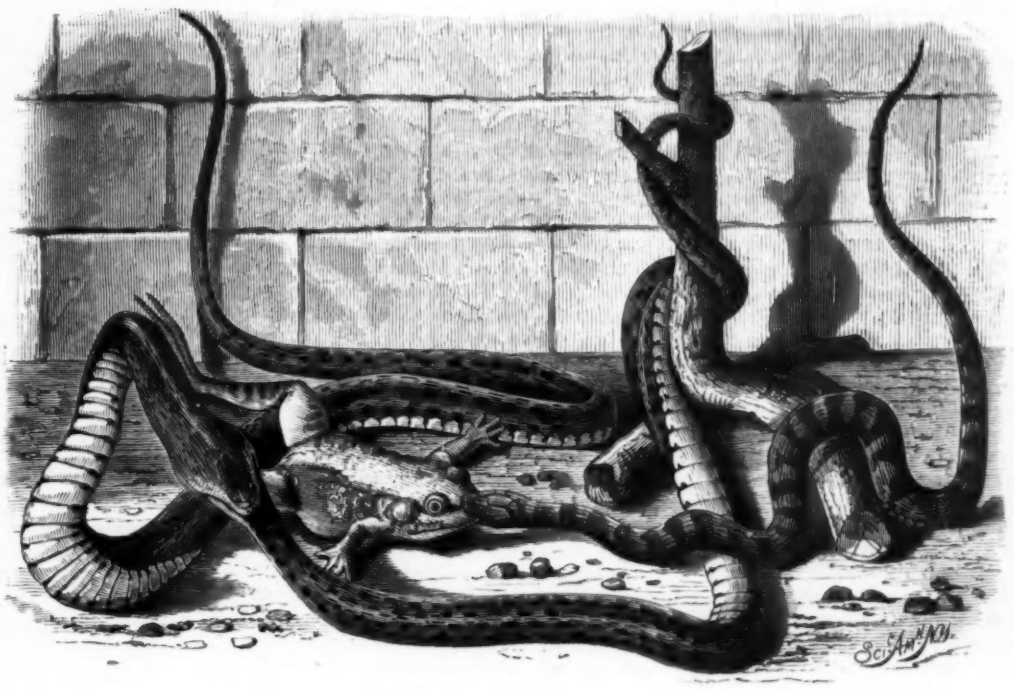
The only advantage that can be alleged in favor of smoking at any time is that it produces a mild narcotism which is soothing to some people, and perhaps adds to the sense of relaxation during a period of rest. Most of its disadvantages we have often recapitulated. Besides its intrinsic harmfulness, the habit is open to special objection when practiced during working hours, and to this point both employers and employed would do well to give more consideration than appears commonly to be accorded. There are three good reasons why workmen should not smoke while at work, namely, it reduces the physical energy by the very sense of relaxation which it imparts; it often causes the smoker to stop work altogether until his pipe is out; and it is dangerous. We do not believe that any man can properly see what he is about with a cloud of hot smoke and gas rising into his eyes, neither can he bestow his full attention on what he has to do, when the pipe must be kept going at the same time. It may be said that even if he stops for a few puffs no harm will be done. Perhaps not so far as one man is concerned, but if all the men in a large concern stop for puffs, the aggregate sum of the stoppages will amount to considerable time lost. A correspondent writes us to say that he recently timed the smokes taken in a day by twelve journeymen painters, who were engaged on a job requiring especial haste. The total number of minutes footed up over a quarter of a day's work, and the employer soon discovered that he could not afford any such loss, and promptly forbade the practice. Not long ago we saw carpenters smoking in an unfinished house while putting in the woodwork. The floors were littered with shavings, and large quantities of other combustible matter were lying about. The accidental dropping of a few sparks from one of the pipes might easily have determined a serious conflagration. If smoking must be practiced, it is much better to confine the indulgence to off-work hours.

AROMA OF BUTTER.—A Silesian farmer suspends in his empty churn a bag filled with fragrant herbs, keeping the churn carefully closed. When churning he attaches similar bags to the dashers.

SERPENTS AT DINNER.

BY C. FEW SEISS.

I extract the following notes from my journal entry of September 28, 1877: "The first living frog we dropped into our snake house to-day had scarcely touched the floor when it was darted upon by a male garter snake (*Eutænia sirtalis*, Linn.) and seized by the knee of the right hind limb. Nearly at the same instant a half-grown water snake (*Tropidonotus sipedon*, Linn.), although too small to swallow the frog, grasped it by the snout, and endeavored to drag it from the jaws of the other snake. The confusion caused by this struggle for a dinner aroused a large female *eutænia*, which hastened to the scene, and immediately seized the frog by the foot of the same leg which was in the jaws of the first snake. The commotion which followed was, for a few minutes, great; the writhing of the serpents while they tugged at the frog, and the vehement struggling and kicking of the frog itself, caused the pebbles to fly and rattle about quite violently. But the female *eutænia* began immediately to swallow the foot and leg of the frog she had seized, and continued to do so until her jaws came in contact with those of the male *eutænia*. The latter was unable to make any progress in swallowing, as he had grasped the frog at the knee, and was trying to force it to flex the leg, or draw the tibia up toward the femur, so that he might swallow them together, or side by side. The female apparently took no notice of the jaws she had thus met on her road to dinner, but swallowed them, the remainder of the head, and the neck also! This unlooked for greediness being contrary to my wishes, I took a smooth ivory paper folder and worked it carefully under her upper jaw, thus unhooking the teeth from the other snake, and so ending the swallowing operation. A moment later, the male drew his head from its distasteful position, and although his neck was much lacerated and was bleeding profusely, he still retained his hold on the frog, and instantly began swallowing it, which he finished in two minutes, we having forced the water snake to unhook its teeth from the frog's snout. The second frog we put in was soon captured and devoured by the disappointed *eutænia*. We then gave the water snake something which might have been a frog, but was—a tadpole."



SERPENTS AT DINNER.

I have never observed an instance of cannibalism among any species of American serpents known to me. We have no *ophiophagi* or snake-eating snakes in this country. The partial swallowing of the *eutænia* mentioned was, I think, unintentional on the part of the swallower, and of course on that of the swallowed.

GATHERING TODDY.

The borassus tribe (*Borassineæ*) of palms consists of trees with fan-shaped or pinnate leaves, a woody fibrous or net-like spathe, and the fruit a drupe. The principal genus is the magnificent Palmyra palm, represented in our engraving. Of this the most important products are palm wine (toddy) and sugar. When the flower spike makes its appearance the operator ascends the tree by the aid of a vine or rope passed loosely around his own body and the trunk. He ties the spathe securely so that it cannot expand, and beats the base of the spike with a short stick. This beating, which is supposed to determine a flow of sap toward the wounded part, is repeated for several successive mornings, when a thin slice is removed from the end of the spathe. At about the eighth day the sap begins to flow at the rate of two pints daily, and continues to exude for four or five months, a slice of the spathe being removed every morning. This juice readily ferments, and is then palm wine or toddy. When distilled it yields the spirit known as arrack, or if allowed to pass to acetous fermentation it becomes vinegar.

THE PALMYRA PALM.

Magnetization of Circular Steel Plates.

At a recent meeting of the French Physical Society, M. Duter exhibited some magnets obtained by submitting circular steel plates to the action of an electro-magnet terminating in a conical point, applied to the center of the disk. In these magnets the neutral line is a circle concentric with the disk. In order to study the magnetism, M. Duter uses a small cylinder of wrought iron fixed at its center to the stem of an areometer floating in water. The force of detachment is estimated by the weight of water caused to escape from the cylindrical vase containing the areometer before contact is broken. The precise instant of contact and of detachment is indicated by an electric signal. M. Duter has thus demonstrated experimentally that the quantities of opposite magnetisms (N and S) were equal in two opposite parts of the same plate. His present investigations now tend to the determination of the conditions existing in plates of different diameter, and it has thus far been found that the force of detachment depends simply on a specific coefficient variable with the nature of the steel and with its thickness.

Moving Bodies Observed in the Blood during Life.

This was noticed in the case of a little girl, aged four and a half years, under the charge of Dr. Sansom, London. The child was admitted into the Northeastern Hospital, the disease having commenced a fortnight before with a pain in her left cheek. Great prostration occurred and increased until admission. Sloughing rapidly took place, the cheek bone became perforated, and the inferior maxillary bone necrosed. Copious hemorrhage ensued on the third day after admission, and on the same day broncho-pneumonia set in. The child died eight days after admission.

The post mortem examination revealed very extensive necrosis of the tissues surrounding the left cheek and left side of the tongue, and necrosis of both superior and inferior maxillæ. The bases of both lungs were consolidated.

On the third day after admission the first microscopical examination of the blood during life was made. The white elements were in excess, and many existed in fragmentary condition. Examined by a high power, a large number of small, highly refractile bodies, resembling minute colorless crystals, were seen in active movement. Reagents acted upon them variously: weak solutions of carbolic acid and of quinine arrested their movements, weak solutions of potash and of sulphuric acid stimulated them. The number of these motile bodies varied greatly at different times. After hemorrhage and fall of temperature they were greatly reduced in number; again, when the temperature had risen to 103° Fah., they were in great abundance. When numerous, they tended to form groups resembling zoöglœa. In size they were one twentieth part of an ordinary red blood corpuscle. Shortly before death ordinary bacteria were observed in addition to the translucent bodies. These latter bodies were found in the urine examined immediately after being voided, and in large number in the fæces. The discharges from the wound also manifested them in abundance.

Investigations respecting the infective character of the blood and secretions were commenced on the second day after the child's death, the fluids preserved for inoculation having been kept in sealed capillary tubes. A healthy mouse inoculated with blood from the right auricle died on the day following, and on examination showed evidence of peritonitis, the exudations containing a large number of motile bodies exactly resembling those present in the blood of the child. A guinea pig treated in the same way died five days after the operation; its blood contained a vast number of the special translucent bodies. Inoculation of the fluids from the seat of the noma was practiced upon a mouse and a cat. Both animals died, and there was a complete absence of the motile translucent bodies from their blood.

It would appear, therefore, that while inoculation of the fluids derived from the diseased tissue produced peritonitis without discoverable alteration of the blood, inoculation of the diseased blood induced septicæmia, with the manifestation of the characteristic motile particles observed in the original disease. The organisms resembled amœbæ rather than bacteria.

Bacteria.

Dr. Arthur Downes and Mr. T. P. Blunt presented to the Royal Society the result of most interesting observations on the effect of light upon bacteria and other organisms. The experiments were carried out in great detail, and their record is too lengthy to be given in full. The deductions to be drfwn may be summed up as follows:

1. Light is inimical to the development of bacteria, and the microscopic fungi associated with putrefaction and decay, its action on the latter organism being apparently less rapid than upon the former.

2. Under favorable conditions it wholly prevents that development, but under less favorable it may only retard.

3. The preservative quality of light, as might be expected, is most powerful in the direct solar rays, but can be demonstrated to exist in ordinary diffused daylight.

4. So far as the investigation has gone, it would appear that it is chiefly, but perhaps not entirely, associated with the actinic rays of the spectrum.

5. The fitness of a cultivation liquid to act as a nidus is not impaired by insolation.

6. The germs originally present in such a liquid may be wholly destroyed, and a putrescible fluid perfectly preserved by the unaided action of light.

We observe with some surprise that these gentlemen, in making the delicate experiments, adopted a plan of first thoroughly cleansing the tubes with strong sulphuric acid, and finally, before use, rinsed them with tap water, then the "Pasteur's solution" was introduced. As tap water in London contains bacteria and numerous other forms of life, it appears an improper fluid to be used for such a purpose. In the course of the investigations it was observed that when bacteria appeared early and in large numbers in the solutions used, the mycelium of penicillium, or other microscopic fungus, was rarely seen, the bacteria apparently preoccupying the ground; when, however, the development of the bacteria was, from some cause, retarded or prevented, tufts of delicate mycelium were frequently found in the solutions after they had been incased or removed into diffused light. No mycelium, however, appeared during the period of exposure of a solution except under certain conditions, nor indeed afterwards, if this was sufficiently prolonged. They infer accordingly that light may retard or altogether prevent the appearance of mycelial fungi, but that its influence in this respect is slower and less powerful than upon the schizomycetes. They suggest also that this may explain, in part at least, the sparing distribution of bacteria in ordinary air, as compared with the prevalence of the spores of penicillium, etc., a fact observed by Burdon Sanderson and others.

Glue and its Manufacture.

Glue is an important commercial animal product, and its manufacture is carried on upon a large scale. Many refuse products are used in its composition; animal skin in every form, uncombined with tannin, may be made into glue. The substances most largely and generally employed are the parings of hides and skins from the tanneries and slaughter-houses, known as glue pieces, fleshings, pelts from furriers, the hoofs and ears of horses, calves, and sheep. The parings of ox and other thick hides make the strongest, and afford about forty-five per cent of glue. Dried sinews, the core or bony support inside horns, fish bones, with membrane and other offal, are also the raw materials used for making glue and size.

The process of manufacturing glue is as follows: The clippings and refuse materials are first placed in a lime pit, and when sufficiently steeped they are immersed in water, well washed, rinsed, and placed on hurdles to dry. Afterwards they are boiled to the consistency of thick jelly, which is passed, while hot, through osier baskets, or bags and nets made of rope, to separate the grosser particles of dirt or bones from it, and allowed to stand some time to purify further. When the remaining impurities have settled to the bottom it is melted and boiled a second time, and when thick enough it is drawn off into a vessel and maintained at a temperature which will keep it liquid. This gives further time for the deposition of solid impurities, and for clarification, by the addition of such chemicals as the manufacturers may prefer.

The glue is then run off into wooden coolers, about six feet long, one foot broad, and two feet deep. Here it becomes a firm jelly, which is cut out by a spade into square cakes, each cake being deposited in a sort of wooden box, open in several slits or divisions to the back. The glue is cut into slices by passing a brass wire, attached to a kind of bow, along the slits. These slices are placed upon nets, the marks of which are seen on the dry glue, and stretched in wooden frames, removed to the open air, placed in piles, with proper intervals for the admission of air, each pile being roofed in, as a protection from the weather. When the glue is about three quarters dry it is removed into lofts, where in the course of some weeks the hardening is completed. The cakes are finally dried off in a stove room at an elevated temperature, which when they are once solid only serves to harden and improve their quality.

Good glue should contain no specks, but be transparent and clear when held up to the light. The best glue swells without melting when immersed in cold water, and resumes its former size on drying. Shreds or parings of vellum and parchment make an almost colorless glue; old gloves, rabbit skins, and the like are frequently employed in this manufacture. The method of softening glue for use is to break it into small pieces, soak for twelve to twenty hours in cold water, then set it over a fire, and gradually raise its temperature until it is all dissolved, taking care to stir it frequently while melting. Prepared in this way it cools down into a stiff jelly, which requires only a little warming to fit it for use. Amber colored glue is that most esteemed by cabinet makers. Glue must not be used in a freezing temperature.

Fresh glue dries much more readily than that which has been once or twice melted. Dry glue steeped in cold water absorbs different quantities of water according to the quality of the glue, while the proportion of water so absorbed may be used as a test of the quality of the glue. From careful experiments with dry glue immersed for twenty-four hours in water, at the temperature of 60° Fah., and thereby transformed into a jelly, it was found that the finest ordinary glue, or that made from white bones, absorbs twelve times its weight of water in twenty-four hours; from dark bones, the glue absorbs nine times its weight of water, while the ordinary glue made from animal refuse absorbs but three to five times its own weight of water.—*Boston Cultivator.*

COLMER'S DOSIMETER.

We illustrate herewith a dose measurer, or dosimeter," the invention of Dr. George Colmer, of Springfield, La.

There has always been an uncertainty in measuring fluids by drops, and this little instrument is designed to enable an apothecary or nurse to determine with certainty the precise dose desired. The dosimeter which Professor R. H. Thurston uses consists of a steel wire tapered smoothly to an extremely fine point. The first drops flowing from this instrument vary in weight, but after a time the most accurate chemical scales fail to detect any variation. But these drops are of course very minute. Dr. Colmer's invention consists in a graduated transparent tube with tapered end, and graduated for indicating drops, minims, or other measures. In the top is fixed a syringe, which has a rod, A, adjustable endwise, so that by turning it, it may be introduced any desired distance into the tube of the syringe, and will thus stop the upward stroke of the piston at any desired point. It is thus possible to positively regulate the quantity of liquid drawn or forced up into the graduated transparent tube. Not a drop will escape until pressure is applied to the piston.

It was patented through the Scientific American Patent Agency on November 13, 1877.

American Exports of Furniture, Coffins, etc.

We are indebted to our ingenious brothers at the other side of the Atlantic for a vast variety of "Yankee notions," in the shape of inventions. They have supplied us with machines for sewing, washing, knife cleaning, egg beating, cinder sifting, apple paring, window cleaning, and many others, from nut crackers to quartz crushers. These we have utilized and appreciated. But it is not only in patented inventions that our American cousins have befriended us. A new trade has lately grown up between Europe and America, which must, sooner or later, be felt in an important branch of native industry. It is not generally known, but such is the fact, that American upholsterers are now exporting to Great Britain and the continent large quantities of ready made furniture, from kitchen chairs and tables to the most elegant accessories of the drawing room. The facility with which these objects are turned out is almost marvelous. The native woods of America are easy to work, and susceptible of a fine polish. The wood applicable to the better class furniture is so abundant that it is wholly superfluous to use veneers. The consequence is, that the objects are manufactured solid, and bear much more wear and tear than articles of a similar class made in England. The prices are also much more reasonable, because skilled labor is, to a great extent, dispensed with, and cheap machinery is substituted for manual dexterity. But it is not only in the matter of household furniture that competition is to be dreaded. The Americans are now sending us window sashes, doors, skirting boards, panel work, wainscots, and all descriptions of joinery. With this assistance, the builder may regard with more composure strikes among the carpenters. But our transatlantic friends do not limit their interest to the living only. Their far-seeing benevolence takes notice of us even in death; for American coffins (vastly superior to the home-made article) are to be had in the market at prices little more than half of those charged by native undertakers.—*Dublin Farmers' Gazette.*

Gunpowder and Nitroglycerin.

According to the *Revue Industrielle* a volume of gunpowder produces at the ordinary temperature 190 volumes of gas. Owing to the heat produced, this gas occupies about four times the above mentioned volumes, or about 760 volumes of gas are produced immediately after the explosion.

A volume of nitroglycerin produces 1,300 volumes of gas at the ordinary temperature, and admitting that the heat produced by the explosion is two and a half times that produced by gunpowder, this volume would be increased to 13,000 volumes.

In building the Tay bridge (the longest railway bridge in the world), at Dundee, Scotland, work was carried on at night by the light of two Gramme machines and two Serrin lamps of 1,000-candle power.

Action of Compressed Oxygen.

Recent investigations have disclosed the fact that oxygen under high pressure rapidly destroys all living beings and organic compounds.

All the varied phenomena of fermentation, in which the chemical action depends upon the presence of living organisms, are, says the *Journal of Chemistry*, completely arrested by the action of compressed oxygen, even if exerted only for a brief time; while fermentations due to dissolved matter, like diastase, perfectly resist its influence. M. Bert, to whom this curious discovery is due, has found a practical application of it in the field of physiological research.

The ripening of fruits is arrested by exposure to compressed oxygen, and hence it must arise from cellular evolution. The poison of the scorpion, on the other hand, whether liquid or redissolved in water, entirely resists the action of the compressed gas.

Such poisons evidently owe their power to chemical compounds akin to the vegetable alkaloids. Fresh vaccine matter subjected for more than a week to oxygen under a pressure equal to 50 atmospheres retained its virtue, from which it would appear that the active principle in vaccine matter is not certain living organisms or cells, as some have supposed.

The virus of glanders, after similar treatment, quickly infected horses inoculated with it; and carbuncular blood, though freed from bacteria, was found to retain its dangerous properties. These must therefore be put in the same class with vaccine matter.

If these results are confirmed by further investigations, the discovery will lead to the settlement of many disputed questions in physiological chemistry.

THE LIFE OF A MILLION PEOPLE.

The supplement of the "Thirty-fifth Annual Report" of the Register General (England) presents some valuable and interesting statistics. The report singles out, in imagination, a generation of one million persons, and traces its eventful journey from the moment of birth to the end of life. Of these, taking the whole of England, more than one fourth die before they reach five years of age, and most of the survivors have been attacked once or oftener by disease. During the next five years the tenure of life becomes more sure, and between five and ten years of age the number of deaths is less than a seventh part of that of the first quinquenniad.

Between ten and fifteen the average mortality is lower than at any other period. From fifteen to twenty the number of deaths increases again, especially among women, many of whom fall a prey to consumption and child-birth. At this period the effect of dangerous occupations begins to affect the death rate. Fully eight times as many men as women die of violent deaths. The number of violent deaths continues to rise from twenty to twenty-five, and keeps high for at least twenty years, that is, until the age of forty-five is reached. Consumption is prevalent and fatal from twenty to forty-five, and is responsible for nearly half the deaths. From thirty-five to forty-five the effect of wear and tear begins to reveal itself, and many persons succumb to diseases of the important viscera. By fifty-five the imagined million has dwindled down to less than one half, or 421,115. After this the death rate increases more rapidly, and although the number of lives grows less, the number of deaths in each of the twenty-five years after fifty-five increases; the higher rate is sustained for ten years longer, until by degrees all disappear.

It is somewhat surprising to find that at seventy-five 161,124 remain on an average; at eighty-five, 38,565, of whom Dr. Farr calculates that only 202 reach the age of one hundred years. At fifty-three the number of men and women surviving is about equal, but from fifty-five and onwards the women exceed the men. Of 100 women living at the age of fifty-five and upwards 11 are spinsters, 43 widows, and 46 wives; of 100 men, 9 are bachelors, 24 widowers, and 67 husbands.

As regards occupation it is interesting to note that while the clergy generally have an average good health, members of the medical profession are subject to a high rate of mortality, which up to the age of forty-five is, we are told, much about the average. Chemists and druggists, commercial clerks, mercers, and drapers also seem to be less healthy than the average. Persons who work in wood, as coachmakers, wheelwrights, carpenters, joiners, and sawyers, have healthier lives than most men. Publicans, butchers, and fishmongers have not, as a rule, good lives. Carvers and gilders, plumbers and glaziers, suffer much from the metallic poisons to which they are exposed, while the mortality of those engaged in earthenware manufacture approaches, after the age of thirty-five, double the average. Tailors and shoemakers are also unhealthy as a class. As might be expected farmers and agricultural laborers are at the present time among the healthiest classes, but the young farmer, for some undiscovered reason, appears to have a less healthy life than the laborer of the same age; from the age of thirty-five and upward, however, the farmer is the healthier of the two.

As to the social condition of the people of England, it may be noted that at the present day, and for the last thirty years, women marry at an earlier age than formerly, one fourth marrying before the age of 21 years.

Among unmarried men the mortality is above the average, but it does not appear whether this arises from the want of domestic comfort, or is due to the fact that the weakly men do not marry.

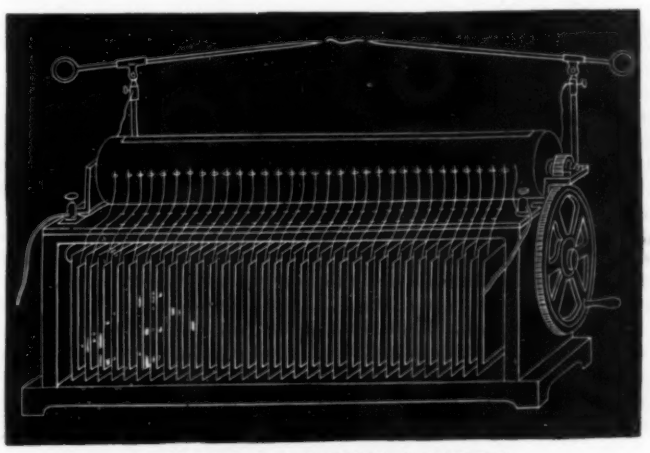
It is also satisfactory to learn that although the birth rate has continued at much the same average, the number of children born in wedlock has progressively increased. The mortality from preventable causes is still much too high.

Notwithstanding all that has already been accomplished much remains to be done to secure a removal of dangerous substances in the air of factories, mills, and shops, such as flour, cotton, vegetable, and mineral dust. A larger and continuous supply of purer water, better and less crowded dwellings, are urgently needed, especially for the laboring classes. Intemperance and excesses of all kinds are known to have a very marked influence in raising the death rate. Speaking of the high mortality among publicans, Dr. Farr says: "There can be little doubt that the deaths will be found due to delirium tremens, and the many diseases noticed are aggravated by excessive drinking. The habit of indulgence is slow poison. The dangerous trades are made doubly so by excesses."

M. PLANTE'S NEW RHEOSTATIC MACHINE.

M. Gaston Planté, a well known French electrician, has recently studied the static effects of voltaic electricity by means of a secondary battery of 800 couples. After having observed how easy it was to charge rapidly with this battery an insulated plate condenser, the plate being thin mica, gutta percha, paraffin, etc., M. Planté connected a certain number of these condensers, composed of mica covered with tin plates. These he disposed like the couples of the secondary battery itself, so as to enable him to charge them in quantity and discharge them in tension.

All the parts of the apparatus were carefully insulated. The commutator was composed of a long cylinder of hard rubber, having longitudinal metallic bands which united the condenser surface and were traversed by copper wires bent at their extremities, the object being to associate the condensers in tension. Metallic wires made spring-shaped were connected with the two armatures of each condenser, and fixed on an ebonite plate at each end of the cylinder, which last may be rotated. "If now the end-conducting wires of the apparatus be brought into communication with the 800-couple secondary battery," says M. Planté, "even several days after the latter has been charged by two Bunsen elements, and if the commutator be rotated, there is obtained, between the arms at which the armatures of the extreme condensers end, a series of sparks quite similar to those given by electrical machines having condensers. By using an apparatus having but 30 condensers, each of 765 square inches of surface, I have obtained sparks 1·6 inch in length. By using a battery of 200 couples I have produced sparks 0·32 inch in length. The discharges of static electricity thus obtained are not alternately positive and negative, but are always in the same direction. Hence the loss of force resulting from transformation should be less than in induction apparatus, for, the voltaic circuit not being closed for an instant, there is no conversion of a part of the current into calorific effect. The machine may be kept in revolution for some time and a considerable number of discharges obtained without apparent enfeeblement of the secondary battery."



M. PLANTE'S NEW RHEOSTATIC MACHINE.

A Race of Pariahs.

Since the middle ages the name of *cagots* has been given to a proscribed race of people dwelling chiefly on the northern slope of the Pyrenees. For centuries they have been objects of aversion to other inhabitants of the region. Possessing, it is said, bodily deformities of a repulsive nature, popular opinion among the peasantry once imputed to them the grossest crimes, compelled them to dwell in isolated localities, and to wear a distinguishing badge, denied them entrance to churches except by a special door, and forbade their participation in religious rites, or even their employment in factories or reception in religious refuges. They could not bear arms, walk barefoot, or drink from public fountains; their testimony in court was always doubted, and they were compelled to marry only among themselves. In this last particular they have always differed from leprous colonies, where propagation of the race is interdicted, and hence, although through the progress of civilization public prejudice against these unfortunates has become greatly modified and they have been accorded many rights, still this anomalous people yet exists and constitutes an exceedingly curious study to the anthropologist.

The theories which have been advanced to account for their proscription are very numerous. One tradition ascribes their descent to the Visigoths conquered by Clovis at the battle of Vouillé, and derives their name from the French words *chiens Goths* (Gothic dogs); another makes them the descendants of crusaders who had returned from the Holy Land, infected with leprosy; another describes them as derived from a community excommunicated by Pope Innocent III. The fact, however, that all traditions agree in ascribing to personal repulsiveness a prominent reason for the isolation of these people, and that the treatment to which by long custom they are subjected is similar in many respects to that applied to lepers, indicates the possibility of some form of leprosy rarely seen at present being the true cause of their proscription.

A careful physiological study recently made by M. de Rochas, of all the settlements of cagots now existing in Europe, exhibits their condition at the present time and sheds some light on their probable origin. M. de Rochas states that scarcely a village exists in the Pyrenees in which a certain quarter has not for a long period been regarded as set apart for the cagots, and that in the churches traces are yet visible of the doors devoted to them, although these portals are now walled up. The prejudice against the race is rapidly becoming effaced. Mixed marriages are more common, and the acquisition of fortunes has elevated the condition of individuals. In three large settlements visited there were very few characteristics observable on the part of the cagots to distinguish them from other inhabitants. Although in all cases mentioned in other visits their rights were curtailed, only one is mentioned where the condition of the race was such as to warrant their proscription, and in this they fully verified tradition in respect to physical and moral repulsiveness.

A curious fact regarding the cagots is that their habits and manners and language are always the same as those of the people with whom they reside. Other scattered races, no matter how widely disseminated, always retain some race individuality. The cagots are destitute of this, and thus theories attributing to them a common national origin are overthrown in favor of the hypothesis of leprosy. This terrible malady was chiefly brought into Europe from the East, and during the 13th century over 19,000 cases were known, 2,000 of which were in France. The disease remained endemic until the beginning of the 16th century, when it rapidly decreased, and now is practically unknown in all European countries excepting in Norway and the Grecian Archipelago. Two principal types of the malady are recognized: Elephantiasis, the true leprosy of the middle ages, and the so-called white leprosy, which is closely connected with albinism of the present time. Of albinism there are also two types, one depending upon a disease, the other being a phenomenon due to the stoppage of development of the coloring matter of the skin. M. de Rochas, who has examined all varieties of leprosy, has distinguished several forms of the disease affecting the cagots, ranging from its lightest manifestation, which simply shows itself in the color of the eyes and hair, up to a horribly repulsive malady. Albinos caused by white leprosy, he states, have white hair and beards, blue eyes, and not red ones as phenomenal albinos possess, muddy skin, and epidermis more or less rough. There is an excessive predominance of the lymphatic system, and the body exhales a peculiar and disagreeable odor. No doubt appears but that this was the disease which affected the cagots of Europe, and which caused them at first to be confounded with the true lepers. The distinction was afterwards made, but the proscription of the former continued, despite the fact that their descendants gradually lost all traces of the infection.

New Agricultural Inventions.

A Moth Protector for Beehives, invented by Mr. J. P. Stroope, of Arkadelphia, Ark., is an attachment for preventing the entrance of millers and facilitating the cleaning of the hive. A hopper shaped sheet metal bottom has an oblong aperture, and below it is an inclined plate. The space between the bottom and plate is of sufficient width to permit a miller to pass, while it is insufficient to admit of the passage of a bee. The aperture to the hive is of sufficient size to admit the bees. The miller follows the plate, and being smaller than the bees passes between it and the bottom of the hive; while the bees, finding it impossible to follow this passage, enter the hive through the aperture mentioned.

Mr. Lyman Norton, of Hartford, N. Y., has invented an improved Harrow. It is square, having a jointed frame, provided with teeth, the draught being from one corner, as usual. In addition there is a toothed cross bar, braced by longitudinal keyed rods and supporting fingers.

A new Cultivator, invented by Mr. J. M. Graves, of Blossom Prairie, Tex., is so adjustable in its parts that the beams and plows may be fixed at any desired distance apart, and is capable of passing over tall plants without injuring them.

Mr. Wm. Smith, of Carmi, Ill., has invented certain improvements in that class of Ditching Machines which have a vertically adjustable plow or cutter, and an endless chain elevator connected therewith, for removing from the ditch the earth loosened and lifted by the plow. The improvements produce a comparatively light and simple machine.

A Reversible Plow, the invention of Mr. Peter Bouchet, of New York city, consists of a duplex share and mouldboard, made in one piece symmetrically to the center joint, swiveled centrally to an adjustable arm, and locked by perforations at both points to a fixed hook at the point of the landside. The colter is adjusted to either side of the point of the landside by a forked lever at the top of the beam, to correspond to the position of the duplex share and mouldboard at the right or left of the landside. The object is to furnish a side-hill plow by which the furrow slice may be turned to either side, as desired, so that the plow may be used while traveling in both directions.

New Mechanical Inventions.

An Apparatus for Hardening and Tempering Saws has been invented by Mr. S. E. Farmer, of Dayton, O. It consists, first, in combining, with a vertically movable anvil or press bed, a vertical follower and automatically releasing supports, by which a saw will be dropped into the bath at the proper time during the descending stroke of the follower and centered upon the press bed; secondly, in seating the press bed upon posts in the tub containing the bath, for the purpose of allowing the scales to fall free from the press bed without destroying its tension with respect to the follower.

An improved Machine for Cutting Horn into Sheets has been patented by Mr. M. M. Goldsmith *et al.*, of New York city. It consists of a grooved table with a fixed cutting knife, adjustable gauge plate, and a toothed or fluted feed roller above the gauge plate. The object is to furnish a machine which will cut the horn without injuring its surface.

An improved Cloth Shearing Machine, invented by Mr. A. A. Forbes, of Valleyfield, Canada, consists of a laterally reciprocating concaved or grooved board, covered partly with a whalebone brush and partly with emery, and arranged above the guide roller over which the cloth runs before it passes to the setting-up brush.

Mr. W. S. Burgess, of Norristown, Pa., has invented an improved Air Pump, designed for running light machinery and for other purposes. A hand lever operates a piston rod carrying two pistons in a horizontal cylinder. Suitable inlet valves admit the air, and egress valves allow it to pass, when compressed, to the point where it is to be used.

Pinchers, designed for applying and securing barbs to fence wires, are the subject of a patent recently issued to Mr. J. W. Edwards, of Oswego, Ill. The handles of the tool are arranged to give a powerful leverage for bending the wires and barbs, and the jaws are provided with suitable grooves and projections.

In a Steam Engine, invented by Mr. Joseph Holub, of New York city, the arrangement of the valve mechanism is such that by turning off steam at any part of the stroke, the engine will always stop with the piston at the center of the stroke, thus avoiding the dead point.

Messrs. A. J. McCollum and Thomas Seely, of Indianapolis, Ind., have invented a Saw Mill Carriage Attachment, by which logs, after being quartered, can be cut up for barrel heads and staves the full length of the logs, the boards being then cut with butting-saws into pieces of the proper length.

Mr. Frank X. Osburg, of Cincinnati, O., has a Hand Press designed especially for compressing cigars, tobacco, and other articles, for packing them in boxes. It has a vertically movable follower, operated by a fulcrumed lever with curved ends, which engage the slotted arms of upright runners. The uppermost position of the follower is adjusted to the height of the box into which the articles are to be packed, so that the press cannot crush or injure the box, but only pack it tightly.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, March 16, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises	6 13 mo.	Saturn sets	5 47 eve.
Venus rises	4 28 mo.	Uranus in meridian	10 17 eve.
Mars sets	11 23 eve.	Uranus sets	5 09 mo.
Jupiter rises	3 49 mo.	Neptune sets	9 20 eve.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Antares rises	0 27 mo.	Alpheratz sets	8 15 eve.
Regulus rises	3 40 eve.	7 stars (cluster) sets	11 31 eve.
Spica rises	8 18 eve.	Rigel sets	11 01 eve.
Altair rises	1 40 mo.	Sirius in meridian	7 02 eve.
Vega rises	10 01 eve.	Procyon in meridian	7 55 eve.
Deneb rises	11 03 eve.	Arcturus in meridian	2 35 mo.
Algol (var.) sets	0 35 mo.	Capella in meridian	5 30 eve.
Aldebaran sets	11 49 eve.	Betelgeuse in meridian	6 11 eve.

REMARKS.

The sun enters the sign Aries and the constellation Pisces March 20, 0h. 46m. evening, at which time Spring begins. Mercury is at superior conjunction March 20. Venus will soon be very brilliant. Mars is situated between the Pleiades and Hyades and nearest the former. There will be an eclipse of Jupiter's fourth satellite March 18. The disappearance takes place at 5h. 28m. morning, at twice the apparent diameter of Jupiter west, and somewhat south of its primary. The duration of the eclipse is 3h. 40m., hence the emersion is not visible. For an inverting telescope the above directions would be reversed.

EVOLUTION.

Professor J. S. Newberry, of Columbia College, lately delivered a lecture before the New York Academy of Science on the subject of "Evolution."

The lecturer took the opportunity of presenting to his audience a careful *résumé* of the various shades of opinion of those who are arrayed in antagonism on this much discussed question. These were arranged under four groups.

The first, that represented by Mr. Darwin, who claim that all the complex and symmetrical forms of the fauna and flora, the animal and plant life of the present day, are derived from simple initial organic points, with the doctrine of the survival of the fittest.

Secondly, those who follow the leadership of Dr. Charles Bastian, who go a step further back, and claim that the initial point of life developed according to the Darwinian hypothesis is a life germ produced from inorganic substances. Of this class are the materialists or Abiogenesists; while Huxley, Darwin, and the most distinguished of modern biologists are Biogenesists; that is, they disclaim any knowledge or comprehension of life, except as the progeny of pre-existent life.

Thirdly, the group of thinkers of which Professor Asa Gray is a type, who accept the theory of evolution as an explanation of the method by which an inscrutable power has produced all the phenomena of creation. Its adherents see in the theory nothing inconsistent with the existence of a supreme Deity or with revelation.

And lastly, the class of which Professor Dawson, of Montreal, is the champion, who reject all forms of evolution as inconsistent with revelation and true science.

Professor Newberry next expressed his intention of stating some of the facts which geology offers to the sincere inquirer after light on this subject, rather than to advocate either one theory or another. In commencing this branch of the subject he observed that in past ages a series of rock formations has been made which inclose relics of animals and plants that lived in former times.

These series of rocks contain a more or less history of the changes which took place on the earth's surface through millions of years anterior to the advent of man.

The fossils of the Paleozoic and Mesozoic ages are about all extinct. It is only when we come to the Tertiary or Neozoic age that we meet with the remains of living forms.

What we call our terra firma is really a type of instability, for under the constantly acting process of contraction, the crust of the earth is constantly being moved and folded, and that somewhat irregularly, so that in all ages some portions of the land have been going up, other portions down, and wherever the surface passed below the sea level the water would flow in and deposit upon it one or another of the kinds of sediment which we find in the series of rocks. Sediments are still forming from the shells and skeletons of animals which inhabit the sea, and which in death sink to the bottom.

In each age there has been a subsidence of the land, which has permitted the sea to flow over and deposit over the submerged surface sediments which contain in greater or less numbers the remains of the animals and plants then living. This rock history is incomplete, because not all the forms of life which existed would be preserved, partly because many were perishable, and chiefly those that inhabited the seas or drifted into them would not leave any relics behind them. This history, though more complete than would be at first supposed possible, is confessedly defective, and has been but partially read. Great areas of the earth's surface have yet been unstudied by geologists.

While the subject is to be greatly illuminated by future discovery, there is very little probability that the general conclusions of paleontology will experience any important modification.

In tracing the appearance of the various forms of life upon the earth, Professor Newberry commenced with the mammals, which began their existence, so far as we know, in the Trias, but throughout the Mesozoic ages held an altogether subordinate and insignificant position.

The reptiles occupied the sea, the land, and the air, for they were swimmers, walkers, and fliers, the sea reptiles resembling the whales as we know them, and the sea serpents as we imagine them to exist at present.

The Professor next referred to the first bird so far as is known, the *Archeopteryx*, and described its form and those of the flying dragons or pterodactyls of the Jurassic and cretaceous periods

In the Tertiary, the vegetation was apparently more luxuriant and beautiful than that of the present day, for the grandest and most interesting of our living forest trees, the great Sequoias of California, the redwood and the mammoth trees, our tulip trees, magnolias, sycamores, and cypresses, are the lingering remnants of the magnificent forests which covered our continent even to the Arctic sea.

The Tertiary has been well named the age of mammals. Brute force then ruled the world; for man, its present master, had not yet appeared on the stage.

During the ice period the climate of Greenland was brought as far south as New York, and broken sheets of ice held all nature in the embrace of death for thousands of years. Whole races of animals and plants perished, but those forms that were driven far south survived, and ultimately moved northward with the amelioration of the climate, and were attended by a new element in the history of the world—primitive man.

Taking the geological record so far as it goes, Professor Newberry pronounced it authentic and credible, containing no personal equations, but automatic and necessarily true. The progress of life upon the globe bore evidence, in his opinion, that it was the expression of a law; in other words, that it is the operation of forces as distinctively determinative as those which produce and guide the motions of the heavenly bodies. The parallelism of the progress of life through the geological ages with that of the growth of an individual from a germ is so close that most students of paleontology are inspired with the conviction that the life forms of the different ages are links in a connected chain; in other words, that the later forms are derivations from those which preceded them.

This is evolution, and therefore most geologists are evolutionists, and they believe that evolution is not only exemplified in the progress of life, but that it is a law of nature.

"We now come," said Professor Newberry, "to the question of questions—What is the cause that has produced the progress of life? One group of geologists, with Mr. Darwin, believes that external influences have alone produced the diversity of animals and plants. Another group believe that the influence emanated from within the organism, and has been an essential feature in its life and growth. External circumstances have a most potent influence, as Mr. Darwin has shown; but we may well question the adequacy of the agencies he invokes to produce all the effects he claims for them. There are many facts which it is impossible with our present lights to reconcile with his theory."

Professor Newberry next indicated some of the difficulties which up to the present time have prevented him from accepting, in all its lengths and breadths, Darwinism as the theory of the Universe, and have compelled him to hold the law of evolution, not as a creed, but as a conviction.

There are the breaks in the chain of life, which, till they are filled, forbid the cautious scientist to accept as demonstrated the derivation of the later forms in all cases from the earlier.

Professor Huxley explains the persistent types of life by saying that if the spontaneous variations of a species do not give it an advantageous form or structure, that variety has not been perpetuated, or no profitable variation has been hit upon. Upon this Professor Newberry remarked:

"To my mind this explanation is inadequate, because I cannot conceive that a highly organized animal with a complicated structure like the nautilus should pass through the revolutions of the globe without being more affected than it has been by external circumstances, unless the life that inspired it was more potent than all surroundings and gave it independence of circumstances. That external circumstances alone could produce such a symmetrical and continuous development of organic forms, is something that with our present knowledge seems to me highly improbable. Geology up to the present time has not a word to say as to the origin of man. The theory that we are descended from apes is a speculation indulged in, based on anatomical resemblances in the living animals. No ape-like man has been found fossil, nor any man-like ape. Remains of monkeys and of savage types of men have been found; but even the Neanderthal skull was of average capacity, and, as Huxley says, might have contained the brain of a philosopher. No geologist professes to have proved anything like a connecting link between man and apes, and until such shall be discovered geology must be silent on the subject."

We fear that our readers on looking over this abstract of Professor Newberry's lecture will have a feeling of regret, that one so eminently capable of taking the highest views of this most important subject, should have almost confined his remarks to rudimentary observations and the antiquities of the subject.

The history of evolution and the geological record are now known to every schoolboy, and it would appear that Professor Newberry must have had but a moderate opinion of the members of the New York Academy of Science, if he thought that a rehearsal of some of the first elements of geology, and an outline of the Darwinian theory, would be news to the scientific academicians.

If those holding leading positions in the scientific world shirk the responsibility of clearly pronouncing their personal views upon subjects they voluntarily discuss before learned bodies, it gives a color to the meretricious statements of those who are now loudly proclaiming that scientists speak with a *suppressio veri*.

New Inventions.

Mr. Jacob Leutzinger, of Hillsborough, Mo., has invented an improved Brake Block Holder for wagons, which consists of an arrangement of flanged plates, having interior projections for preventing the brake block from slipping, which are clamped together by bolts, and secured to the brake bar by a recess or lug.

A Device for Calculating Percentage, intended for lessening the labor involved in computing taxes and similar fixed percentages, consists of a table formed in radial columns, over which a pivoted indicator is moved, the arrangement being such as to show at once the amount of tax upon any given sum. This device is the invention of Mr. J. L. Knight, of Topeka, Kan.

In a new Animal Trap, invented by Mr. David McGuire, of New Garden, Mo., the cage slides upon a central upright rod, is detached and falls when the trigger, holding the bait, is actuated, and is kept from being lifted from the bottom of the trap by a spring catch.

An Ointment for use in skin diseases has been patented by C. J. Beattie, of Pueblo, Col.

Mr. S. A. Brumbaugh, of Harrisburg, Pa., has invented a Coupling for soft metal pipes and hose, which consists of a short tube, with ratchet threaded conical ends, which fit into the ends of the pipes to be coupled. A central collar has apertures to receive a spanner.

A Stirrup Supporter, the invention of Mr. L. F. Johnston, of Pocahontas, Ark., has a spiral spring, contained in a slotted rectangular case, so arranged that the stirrup straps pass over a sliding plate at the upper and movable end of the spring.

In a new form of Wheelbarrow, invented by Mr. Wm. Eckert, of Jersey City, N. J., each side bar is made of a continuous piece of angle iron twisted about one fourth of a turn at its forward end, in such a manner as to present one of its flanges for the reception of the bearings of the wheel, and the other for the support of the box of the barrow. Wooden handles are attached to the rear ends of the side bars.

Mr. Isidor Kann, of New York city, has invented a Hair Crimper, in which the bent wire or hair pin has a notch or loop formed in its bend to receive the eye of the binding wire and prevent it from slipping.

Messrs. A. Milne and A. Jourdain, of Newark, N. J., have invented a Watch Crown which dispenses with the usual brass core. It has an inner shell or section of suitable thickness, to which a steel socket is attached, and an outer covering shell.

In a new Shutter, invented by Mr. Asher Bijur, of New York city, the slats are adjusted at any inclination and retained in position without any visible slat rod. The mechanism is arranged on the inside of one stile of the shutter frame, and is thus protected from corrosion. The slats swing in end journals in a detachable frame, and motion is communicated by short crank arms connected by a rod and counterbalanced.

A Reversible Latch, consisting of a sliding bolt acted upon by a spring, and operated by a cam of the spindle socket, has been invented by Mr. C. H. Labelle, of Keeseville, N. Y.

Mr. August Hoen, of Baltimore, Md., proposes to provide street lamps with Reflectors, which may be adjusted at various angles for deflecting and thereby utilizing the rays of light which would otherwise escape upward in an oblique direction.

Mr. Daniel Hayes, of New Orleans, La., has invented an improved Mode of Stowing Cotton Bales in the holds of vessels. The inventor proposes connecting the two opposite upper and lower surfaces of two adjacent bales by hooks and an adjustable chain, while under the pressure of the jack screw.

A Chest Protector, invented by Mr. G. F. Jackson, of Minneapolis, Minn., consists of a chamois pad, formed by the combination of a front and a back pad, to be used singly or in connection with an under vest of suitable material.

A Marking Device, intended to take the place of stenciling and brush marking, has been invented by Mr. W. T. Morgans, of Liberty, N. Y. The invention consists of a stock having a groove in its curved face for receiving types, together with suitable clamping devices for retaining the latter in place.

Mr. Martianus Ross, of Abilene, Kansas, has patented an improved Bootjack, the essential features of which are the addition of a rigid heel piece at the rear end, to prevent the foot which holds the jack in position from slipping, and a rounded-off bow or toe piece, which bears on the toe of the boot to be removed.

A Window Blind Stop, invented by Mr. W. B. Surdam, of Fort Dodge, Iowa, consists in the combination, with the blind slats and their connecting bars, of pivoted levers arranged on the blind frame, and operating levers passing through the casing, in such manner as to furnish a secure locking device.

Patent No. 200,000, of the United States Patent Office, covers the claims of Messrs. Mortimer Shea and J. McC. Hamilton, of Nashville, Tenn., relating to an improved Carbureting Apparatus for enriching illuminating gas, mixing and thus diluting it with air in suitable proportions, carbureting air, and thus making gas from gasoline or other volatile hydrocarbons, and for other purposes.

Mr. T. P. Magruder, of Rushville, Ill., has invented an improved Gate Latch, which is semicircular in form and provided with a lug through which passes a screw whose arrangement with reference to the latch guard, or other fixed abutment, adjusts the latch so that it will always strike on the bevel of the keeper, and thus enable the gate to latch easily when swung shut.

A new Temporary Binder, or file for letters, receipts, and other papers, has been invented by Messrs. J. W. Shoemaker and Samuel Dodsworth, of Leavenworth, Kansas. It has a combination of fixed vertical tubes, which hold the papers, and needles having transversely apertured heads, whose shoulders rest on the top of the tubes, while the shanks of the needles extend down into the tubes; these are arranged on a plate of suitable material, one edge of which is turned up at right angles to form a gauge for evening the papers.

Mr. C. C. Schwaner, of Winterset, Iowa, has invented an improved Trace Carrier, which is claimed to prevent the eyes of the traces from being detached, and to be so arranged that the lines or tail cannot catch upon it, while the traces may be readily taken out of the carrier when they are to be applied to the whiffletrees.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

Notes & Queries

E. L. C. is referred to p. 396, SCIENTIFIC AMERICAN, December 22, 1877.—C. L. P.—As we understand you, it does not appear to necessarily make much difference.—W. C. is referred to SCIENTIFIC AMERICAN January 7, 1866, pp. 22, 23; September 29, 1877, pp. 195, 196; October 6, 1877, pp. 207, 212.—J. S. D.—See SCIENTIFIC AMERICAN, January 30, 1875, pp. 64, 65.—D., F. & Co.—We do not recommend special manufactures in "Notes and Queries."—J. G. P.—See SCIENTIFIC AMERICAN, January 19, 1878, under head of minerals.—W. H. C., P. M. Co., and others.—We do not give addresses in this column.—T. J. S.—See SCIENTIFIC AMERICAN, February 2, 1878, pp. 64, 65, 71.—C. B. M.—Write to the Secretary of the Navy and to the Congressman from your district.—F. I. should consult some standard treatise on the subject. The explanation would require more space than we can give it in these columns. There are tables in print complete enough for most purposes.—J. M. L., and others.—Insert a notice in the "Business and Personal" column.—W. W. M.—It will be perfectly safe, if the old boiler is in good condition.—F. L. can obtain explanations from the publishers.—M. C. F.—Consult any modern arithmetic.—J. S. H.—If you have a chimney high enough to give a good draught, we think you will find the proposed mode of setting satisfactory.—H. V.—From your account it looks as if there were a leak either in the pump packing or in the connections. A check valve, it seems to us, would be of no advantage.—W. P. R. will find the information in any good modern geography.—A. does not furnish sufficient data, but it appears safer to use wrought iron for any pressure.—W. F. B.—You might make the machine in the manner shown in the sketch, so far as we can see.

(1) W. G. W. wishes to know how to get rid of cockroaches. A. A mixture of red lead, Indian meal, and molasses will be eagerly eaten by them and will soon exterminate them. Paris green, phosphorus, or arsenic are sometimes used, but are very dangerous. Borax, to which cockroaches have a great antipathy, will drive them away.

(2) J. R. B. asks: What is the method of skeletonizing the leaves of ferns, etc.? A. These skeletons are usually prepared by soaking the leaves in blood-warm water until the thin membranous parts have become sufficiently softened by putrefaction to be easily washed out. Dip the remaining portion in a dilute aqueous solution of sodium sulphite, and dry slowly on a piece of bibulous paper in the air.

(3) H. B. writes: In a recent article in the SCIENTIFIC AMERICAN concerning the Barclay street fire, it is stated that a considerable quantity of chlorate of potash was stored in the building, and it occurs to me that the secret of the explosion might perhaps be found in the fact that a mixture of this salt with loaf sugar becomes explosive when it is acted upon by a third substance that has the property of liberating the oxygen contained in the chlorate, as, for instance, sulphuric acid. The finer the particles, the more perfect the union and more rapid the explosion. An investigation into the articles commonly in use by confectioners might possibly discover some substance which was capable of producing this effect. As two of these substances were present in the building this theory seems fully as plausible as those that have been presented, if not more so. A. True; but the third substance—a concentrated acid—was wanting. The hypothesis, as well as that involving undue friction in compounding the chlorate lozenges, was, we believe, fully considered and disposed of in the investigation.

(4) B. W. asks: How can human skin be tanned? A. Either by the ordinary tannic acid bath or by the alum process. 1. Roll the clean skin up with a thick layer of ground hemlock bark between each convolution, cover it with water in a suitable vessel, and allow it to remain thus until the gelatinous tissues have become converted throughout. 2. Soak the skin in water, scrape off the epidermis, pass through and then digest for 10 minutes in a boiling bath composed of 1 lb. salt, 5·2 lbs. alum, and 6 gallons of water; then add 6·7 lbs. wheat flour and the yolks of 21 eggs to the warm alum bath, and digest with the skins for a day or more. The proportions are for 40 skins. The skins to be dried on stretching frames in the air, moistened with water, rubbed, and after a few hours ironed.

I inclose an illustration of a fountain in which (without any apparent pressure) the water rises above its own level. Will you explain the reason? A. The principle concerned is that of Hero's fountain, described in most elementary works on natural philosophy. It depends on the transmission of the pressure sustained by a body of water in one vessel to that in another by means of the elasticity of the air.

(5) C. T. H. writes: I intend building a dry room to dry animal scraps. Would it be better to have plenty o. ventilation, and so arranged as to have a good circulation of fresh air passing through the room, or should I have just enough ventilation to carry off the damp vapors? A. Plenty of ventilation is best.

(6) C. H. S. asks: In what part of the drying room of a laundry should the ventilators for carrying off the steam (or rather the evaporation) be placed? A. At the bottom near the floor.

(7) J. W. asks: 1. Which is the stronger and will stand the weather better, a pressed brick or a hand made brick? A. The pressed brick is the stronger, and will stand the weather better than the common brick, when equally well burnt. 2. Can a man lay as many pressed brick a day as he can hand made brick? A. No.

(8) G. P. H. asks: Is it practicable to irrigate a tract of land lying about 100 feet above the level of a river? The land very gradually recedes from an elevated point, 200 feet from the river, where a reservoir could be made. What power and pump must I use to irrigate about 25 or 50 acres of this land? A. It is practicable to do so, but before the kind of pump and size can be determined, it will be necessary to have some further data, as, first, the kind of soil; second, the amount of rainfall; and third, the nature of the crops to be raised.

(9) A. S. writes: My dwelling house is situated on the most elevated point of my farm, the ground sloping gently therefrom on all sides; at a distance of about 900 feet from my house a small creek flows through the farm, which is mostly fed by three never-failing springs close together at this point. I am about excavating for, and having a small fish and ice pond, of about 80 x 200 feet, and from 2½ to 6 feet in depth, constructed in such a manner that all the springs will flow directly into the pond, while the rain water of the creek will flow past. In the attic of the house are two tanks holding about 20 bbls. each, besides another tank holding about 15 bbls., which is used for supplying the house with hot and cold water according to modern improvements; this tank is in turn supplied with water from the cisterns by a force hand pump, and works very satisfactorily, and with but little labor. The top of the two large tanks is about 38 feet above the ground about the house, and this surface is about 40 feet above the level of the water in the pond. I am also about constructing a small fountain in front of my house which I intend to supply with water from these tanks. What is the best, the cheapest, and the most satisfactory mode of filling the tanks with water from the pond, so as to keep the fountain playing at least during the spring, summer, and fall months? I will further add, in case a ram should be suggested, that a fall of 3 feet can be obtained for a distance of the first 10 feet, and about 1 foot for every additional 10 feet in distance; but I doubt very much whether that would be sufficient fall for the work required, and besides in very dry seasons, although the springs never fail, yet they get very low, and will probably not yield more than a barrel an hour each. A. By setting the ram in a pit in the ground, the requisite descent for the supply pipe can be obtained, provided a low point can be secured to which to drain the waste water. The ram will then throw the water to the required distance and elevation, if you provide pipes of a sufficiently large diameter for the purpose. Let the orifice in the ram be enlarged to 2 inches in diameter, and the pipes be of the same size. Sometimes two rams are set connected by proper valves to the same pipes, so that one may be repaired without stopping the supply of water.

(10) S. S. asks: What is the largest gun ever made? A. The 100 ton guns made in England for the Italian navy are the heaviest thus far, but still larger ones are projected.

(11) J. W. M. asks: Can a locomotive, on a straight and level track, pull a train attached to it by a connection 100 yards long as easily as by the ordinary coupling; and can an engine drive a circular saw, distant 100 feet, as easily as if the latter were only 10 feet from it? That is, does distance add resistance? A. As we understand your question, neglecting the weight and rigidity of the lengthened connection, there will be no difference in the two cases.

(12) A. A. G. asks: What is the most successful method of preventing wrought iron from rusting, when laid in the ground? A. Galvanizing, we think.

(13) J. F. asks: What will be the effect on a boiler of water containing 19 grains of sulphate of lime and 2 grains of vegetable matter to the Imperial gallon? A. Scale will be formed, unless you purify the water.

(14) C. A. S. writes: Suppose a cannon ball were fired out of a cannon in a vertical position; when it attained the height reached by the force of gunpowder, would it return to the earth at the same velocity it ascended? A. No.

(15) E. P. C. writes: The water in a boiler of a high pressure tugboat was blown off the other day, washed and filled up the next day, and just as the fireman started the wood in one furnace and was going to start the other, he heard a report as if something had given away inside the boiler, and when he investigated the matter he found a crack in one of the side sheets about 14 inches long, taking in three socket bolts. The boiler is only two years old. Can you throw any light on the subject? A. We judge, from your account, that the mischief was done when the boiler was blown down, by allowing it to cool too rapidly, and was developed as soon as the iron was reheated.

(16) M. M. C. writes: 1. Is there not something wrong about the following formula for flywheels, taken from Rankine's "Machinery and Millwork:"

$$w = \frac{m g \Delta E}{v'^2}$$

If v'^2 is taken to mean the square of the velocity of the rim in feet per minute, it gives an answer absurdly small; and if a second be substituted for a minute, the reverse is the case. A. The velocity in the formula referred to is in feet per second, and the formula, we think, gives correct results when rightly applied. 2. Does Rankine's "Manual of Applied Mechanics" give examples of the practical application of his formulas to the construction and designing of machinery? A. Rankine's "Applied Mechanics" simply shows the manner of determining the various formulas. The applications are given to some extent in his "Machinery and Millwork" and "Treatise on the Steam Engine."

(17) F. S. M. asks: Has common gun or blasting powder more of a tendency to throw up than in any other direction? A. We imagine the tendency is to throw in any direction in which the resistance to motion is least.

(18) I. H. P. writes: I am desirous of constructing a counter fountain, to play beside my soda fountain, and not having aqueduct water I will have to appeal to you for instruction. I see an automatic counter fountain advertised, but it does not throw a stream with sufficient force. I want a jet to play under a bell glass with such force that it will cause that peculiar ringing noise which makes such fountains so attractive. A. By using a reservoir of compressed air, you can obtain as powerful a jet as you desire.

(19) W. E. writes: Please inform me of a practical method of mixing plumbago with molten copper, tin, or lead. I am sure that it can be done, but I do not know what is put in with it to fasten it. I have tried, but it will not mix, nor does the plumbago affect the metal at all. A. Heavy pressure may possibly be more efficacious than high temperature.

(20) W. H. W. asks: How can I remove a thick deposit of scale and mud from the tubes of my boiler (locomotive type)? A. Some forms of scale can be softened and washed out by allowing the water to remain in the boiler, after the fire is hauled, until it is quite cool, and then running it out. Other kinds of scale are so hard that the only practical means of removal is by taking out the tubes.

(21) E. J. M. asks: How can I construct a barometer? Must I use alcohol, and what other substance must I use in conjunction with it that will rise and fall in the glass as the changes in the atmosphere occur? A. Mercury is the liquid ordinarily used in barometer tubes, since the column of liquid is sustained by atmospheric pressure, and would be inconveniently high if alcohol was employed. You can purchase accurate mercurial or aneroid barometers of a dealer in scientific instruments, or may try the plan described in the SCIENTIFIC AMERICAN of March 2, 1878, p. 135.

(22) H. L. writes: Two tanks stand side by side and connect through a short pipe. A pipe descends from each 12 feet, and each pipe enters an iron box in the stove. The tanks are filled with cold water, and by means of pipes and box a complete circuit of water is established. When a fire is put in the stove the water in the box is heated, and hot water passes up one of the pipes to the tank. What gives the hot water a tendency to one pipe rather than the other? One philosopher answers the question by saying that one pipe enters the box at a higher level than the other. That does not quite satisfy me. A. We think it probable that the philosopher's view of the case is correct, if the facts are as he states.

(23) H. C. M. recommends that B. P. L. (p. 140, current volume) try the following, to stop the leaks in his skylight: 20 parts white sand, 2 parts litharge, 1 part lime; mixed dry and then with boiled linseed oil. Our correspondent states that this mixture will set very quickly and make a hard cement.

(24) W. H. C. writes: I have a Selden steam pump; diameter of cylinder 8 inches, stroke 8 inches, bore of water cylinder 3 inches, ¾ inch live steam pipe, 1 inch exhaust, 1½ inch suction pipe, 15 feet long; it discharges through 1½ inch pipe about 70 feet, with about 40 feet rise above the level of the pump. The friction in the discharge pipe consists of 10 ells, 4 unions, 1 T, and 2 1¼ inch Globe valves. The pump does not work very satisfactorily. I think that the pump will do its work better if fed through a 1 inch steam pipe, with 1¼ exhaust. The person who put it up says it would be of no advantage to connect it differently. I am now using 20 lbs. steam. A. An increase in the size of the discharge pipe would probably be more beneficial.

(25) W. E. L. writes: We force water from a well 70 feet up to a tank by means of a Hooker pump. It discharges into the tank from the top. If the pipe had entered from the bottom about 50 feet of pipe could have been saved, but it was thought by a friend that the pressure from the water in the tank would be too great for the pump. I claimed it would be no greater from its entering the bottom, in fact not so great, unless the tank was kept full. In putting in the pump, the original suction was 2½ inches, and the discharge 2 inches, but he changed it and made the suction pipe the same as the discharge, and said it would be better if the suction was ½ inch smaller than the discharge. This I claim was wrong, and that the suction should be larger than the discharge. A. As you state the cases, we are inclined to agree with you.

(26) M. J. C. writes: Please explain the interior construction of the American steam gauge, or how the steam acts on the interior so as to indicate the pressure on the dial? A. The pressure acts in a coiled elliptical tube, tending to make it round, and the end of the tube is connected to the hand by levers or rack work.

(27) P. R. writes: 1. I have an old electric battery. I wish to use it for giving shocks, sparks, and for heating small wires. Please tell me how to connect and charge it. The battery consists of a rectangular box (of vulcanized rubber) 12 inches long and 7 inches wide by 9 inches deep; divided into four compartments, two zinc and one carbon plate (6 x 8 inches) for each division, hanging on an insulated brass rod, with knobs of the same metal on each end, resting in bearings at each end of the box. A. You can charge your battery with a solution of bichromate of potash in water acidulated with about one thirtieth of its weight of sulphuric acid. Connect the two zincs of one compartment with the carbon plate of the next compartment, so that one terminal of the battery will consist of two zinc plates and the other terminal will be a carbon plate. A wire connected with the two zinc plates is called a negative pole, and a similar wire connected with the carbon plate is called the positive pole or terminal of the battery. Now if your zincs are thoroughly clean and the connections well made, a very fine shred of platinum placed between the poles so as to be in circuit will become white hot. To give shocks you will need an induction coil (see p. 251, SCIENTIFIC AMERICAN of October 20, 1877), having its primary coil in connection with the poles of your battery. 2. What kind of cement shall I use to repair the box? There are some cracks in the bottom of it. A. Have the box thoroughly dry and clean, and fill the cracks with a mixture of rubber cement and pulverized sulphur.

(28) H. D. I. asks: What is the diameter of the disks in M. Trouvé's moist battery, described in the SCIENTIFIC AMERICAN of October 3, 1877? A. They may be made about 6 inches in diameter.

(29) C. H. B. asks for instructions in preparing paper for taking leaf photographs. A. Pass the paper first through a solution of gelatin, 1 part in 20 parts of hot water, and use a strong solution of potassium bichromate; or the gelatin and bichromate may be used

together. Wash with hot water. A strong blue background may be produced as follows: Dissolve in 2 ozs. of pure water 120 grains of red prussiate of potash (potassium ferrocyanide), and separately 140 grains double citrate of iron and ammonium in 2 ozs. of water; mix the solutions, filter, float the paper for a few minutes on the filtrate; print from the dried paper as before, and wash thoroughly in water. By adding a little phosphoric acid to the bichromate solution and exposing the print before washing to the vapor of a hot solution of aniline in alcohol, a blackish-green or red positive is obtained. Or, prepare the paper with solution of iron sesqui-chloride, and develop after exposure with a very dilute solution of silver nitrate. Use plain photographic paper.

(30) J. B. N. asks: What is the method of proportioning pulleys of different sizes, so that the same belt can run on all without change of length? A. Draw vertical lines parallel to each other and an equal distance apart; these will represent the center lines of the width of the steps upon the cone. Draw at a right angle to these lines and passing through about the center of their lengths a horizontal line, representing the axis of the cone pulley. Set the compasses to the radius of the largest step of the cone, and from the intersection of the end vertical line and the horizontal line used as a center, place on that vertical line a mark above and below the horizontal one. These two lines will represent the diameter of the largest step. Set the compasses to the radius of the smallest step required on the cone, and mark off in a similar manner the diameter of the smallest step required on the cone. Take a straight edge and place one edge even with the intersections of the vertical lines at each end with the lines marked by the compasses, and then draw a line intersecting the intermediate vertical lines, and the intersections of the lines drawn from the straight edge with the vertical lines will show the required diameter for each step of the cone.

(31) C. W. writes: A lubricant which I have been using, when it comes in contact with brass, turns it green. What is the cause? A. Probably the presence of a certain amount of moisture in the lubricating oil, causing the brass to oxidize.

How can I make a conductor to draw off frictional electricity? A. Brush some gum water over the outside of a base ball. When this is almost dry, roll the ball on gold leaf so that the ball will be covered with a smooth layer of gold; then mount the ball on a stick of sealing wax, set in a little wooden disk or base. Then on one side of the equator of the ball insert five or six cambric sewing needles, so that they will be about ⅛ inch apart; these needles act as a comb to conduct the electricity to the gold leaf on the ball, from which the electric sparks may be drawn. In some establishments where leather belts are run at a very high speed, electricity is produced on the belts. If the conductor that we have just described be placed with its row of needles near to, but not touching, one of these belts, the electricity of the belt will be accumulated, and will manifest itself in the form of the bright blue sparks, several inches in length, that pass from the conductor to the knuckle of the hand that is presented to it.

(32) D. J. K. asks: With what shall I oil a black walnut case? A. Raw linseed oil. Sometimes a little turpentine is added, in the proportion of 1 gill to 1 quart of the oil.

(33) L. H. wishes to know what to line wooden battery tubs with, to make them water-tight and protect them from acid. A. Use paraffin wax, applied hot.

(34) F. C. S. asks: What is the rule for calculating the change wheels for a compound screw cutting lathe? A. Divide the pitch of the thread to be cut by the pitch of the lathe feed screw, and the product will be a proportional number. Then multiply the number of teeth in the lathe mandrel gear by the number of teeth on the smallest gear of the compounded pair, and the product by the proportional number; then divide the last product by the number of teeth in the largest wheel of the compounded pair, and the product is the number of teeth for the wheel to be placed on the feed screw. Or, if the sizes of two wheels are to be found, divide the number of threads you wish to cut by the pitch of the feed screw, and multiply the quotient by the number of teeth on one of the driving wheels, and the product by the number of teeth on the other of the driving wheels; then any divisor that will leave no remainder to the last product is the number of teeth for one of the wheels driven, and the product is the number of teeth for the other wheel driven.

(35) M. D. V. asks: What is the best method of calculating the speed of pulleys, from large to small, and from small to large? A. The speeds of two given wheels are in the proportions or ratios of their diameters. To find the sizes of wheels for a required speed, multiply the speed of the driving wheel by its diameter and divide by the speed required by the driven wheel. The answer is the diameter of the driven wheel. If two pairs of wheels are concerned, divide the speed you require the wheel to run by the speed (in revolutions) of the driving shaft, and the quotient will be the proportion between the revolutions of the driving shaft and the revolutions required. Then take any two numbers that will when multiplied together form a sum equal to that proportion, and one of such numbers will form the relative sizes of one pair of pulleys, and the other of such numbers will form the relative sizes for the other pair of pulleys.

(36) F. K. R. asks: What is the composition used for melting brass to make it retain the size of mould when cooling? I wish to cast the brass in an iron mould, and if it should shrink I could not get it out. A. We know of no composition in use for such a purpose.

(37) C. E. C. asks: What metal or combination of metals should be used for making joints in a sheet lead tank to be used for storing oil of vitriol (66°)? A. Use a solder of 1 part lead and 2 parts tin.

(28) R. H. writes: I wish to make a small boiler for a little engine (cylinder 1 x 1½ inches) which I have constructed. I propose to make it 10 inches high and 6½ inches diameter, and containing 5 one inch flues; it is to be made of cast iron, flues and all. Metal is to be ¼ inch thick. Do you think such a boiler would answer my purpose? I wish to generate steam with a lamp, and I have been thinking that the metal is too thick to do so. Can you tell me of a better way to build a boiler? A. We are not favorably impressed with your plan, and think it would be better for you to build the boiler of wrought iron or copper. You could not conveniently use a lamp for generating steam in the proposed boiler.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

A. E. A.—It is a zinc blende; silver is present in small quantities.—Package marked Santa Fé contains dogtooth spar and agate pebbles.—F. J. R.—No. 1.—The quartz looks well and may be metalliferous; the sample is not notably so. No. 2.—The powder consists principally of magnesium, calcium, and alkaline chlorides, sulphates, carbonates and silica. It contains also organic matter, ammonia salts, phosphates, iron, and a trace of fluorides. It is not of much value. It is probably the residue from the evaporation of spring water—mineral water.—F. C. B.—The marked sample is an amorphous sand—principally silicic acid. The other is an impure clay—silicate of alumina.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Cuca or Coca. By C. H. E.
A New Source of Power.
The Use of Petroleum as Fuel. By H. B.
Centering for Arches. By P. I. O.
A New Vehicle. By R. B. F.
The Use of Fuel for Steam Boilers. By W. S. C.
The Electric Light. By W. E. S.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 5, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Advertiser, clock, J. F. Werner	200,009
Album, J. C. Koch, Jr	199,982
Animal trap, D. McGuire	199,987
Apple paring machine, Goodchild & Hay	199,903
Bale tying machine, F. S. Heath	200,059
Bed clothes clamp, C. M. Bryson	200,025
Bee hive, J. Palmer	200,064
Bee hive, J. P. Stroope	200,004
Binder, Shoemaker & Dodsworth	199,998
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Blind slats, J. G. Wilson	199,948
Blind stop, W. B. Surdam	200,005
Book binding, J. S. Lever	200,063
Boot jack, M. Ross	199,996
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Brake coupling, F. W. Eames	200,051
Brake, wagon, S. Gorr	200,061
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Button or stud fastening, R. Boussard	200,023
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Car registering apparatus, R. McCully	200,075, 200,076
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Cigar support, F. L. Oviatt	200,063
Cigar wrapper cutter, F. Haehnel	200,055
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Skate, S. Horsford	200,012
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Universal joint, J. L. Follett	8,069
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Vise, W. Starkey	200,063
Wagon jack, M. C. Flanders	200,101
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Wheel, vehicle, J. Raddin	200,052
Whiffletree, R. R. Beavers	200,088
Windmill wheel, A. Klotz	199,894
	200,066

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January 28 to February 7, inclusive.

Boot and shoe heel.—G. B. Massey *et al.*, N. Y. city.
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Gas manufacture.—G. Ramsdell, Oswego, N. Y.
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Pump, compressing and exhausting.—G. F. Blake, Boston, Mass.
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Sieve.—G. W. Ketchum, Newark, N. J.
Slate-dressing machine.—A. Auld, Jr., Cleveland, O.
Spinning mule.—M. C. Patrick, Lowell, Mass.
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